Communicating Adaptation: Using Psychological Insights to Facilitate Adaptive Responses to Climate Change Impacts

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Abstract

Climate change has been described as the greatest threat to human health in the 21st century. The influence of human activity on climate change is unequivocal, climate change impacts are already affecting people's lives and, even with rapid greenhouse gas reductions, some further warming of the planet is inevitable. Despite the threat of climate change, adaptation efforts to date have been limited. In turn, the way people communicate about adaptation can play an important role in facilitating adaptive responses to the threats posed by climate change. Communications informed by psychology can influence cognitive, affective and behavioural engagement with adaptation, leading to changes at the individual, community and broader socio-political level. However, communication about adaptation has largely been neglected in favour of communicating mitigation, and further research is urgently needed to address the social-psychological complexities of engagement with adaptation.

This thesis sets out to advance knowledge about both (a) the psychological factors that shape individual-level 'adaptive responses' (i.e. behaviours aiming to reduce the negative impacts of climate change) and (b) how such knowledge can inform communications interventions. Focusing on emerging climate impacts in a UK context (including flooding and public health), the research considers how communications can be optimised by harnessing the most significant psychological mechanisms that promote adaptive responses. Investigating these issues through a set of incremental, novel, mixed-methods studies, the project addresses not only how people cope with the unfolding threats of climate change, but also interrogates how communications framings can be appraised as threatening or non-threatening. Throughout, the work draws on the Protection Motivation Theory (PMT) model, which has previously been used to explain responses to environmental stress and health communications.

Following a literature review, interviews with flood victims were conducted to explore people's socio-cognitive experiences of a major flood event *(Chapter 3)*. The key themes emerging in these interviews were then used to inform a quantitative survey, where models of behaviour and policy support were tested in relation to flooding and climate change *(Chapter 4).* Together, these studies informed a communication testing phase, leading to a fork in the thesis. Two experiments were conducted to understand people's responses to threatening and non-threatening communication styles, and the possible influence of perceived majority-minority status *(Chapter 5 & 6).* Additionally, a national survey tested different framings and imagery related to the health impacts of climate change *(Chapter 7).* Finally, an academic placement was conducted, where findings were translated into real-world climate communication practices through co-created activities *(Chapter 8).* In total, over 1,500 participants took part in the research.

A range of theoretical contributions were generated through this work. In particular, the findings highlight the consistent influence of efficacy beliefs on climate adaptation behaviours, going beyond past work to show that different types of efficacy (self, response and collective) influence responses at personal, policy and broader social levels. Other factors, including threat appraisals, descriptive social norms and freedom threats were also shown to influence responses to adaptation. In turn, the work demonstrates how non-threatening communication approaches, visuals and collaborative engagement can influence efficacy and facilitate adaptive responses,

and how health impact framings can increase concern about climate change in the UK. Perceived minority status and request styles were also shown to influence how favourably people responded to communications. Together, the work explains that the PMT model can be usefully modified to better explain the communication of climate adaptation.

In turn, the research has substantial practical implications for climate change communications. In particular, the research demonstrates the importance of using communications to nurture people's sense of efficacy to respond adaptively and suggests efficacy messages should be tailored to the response level being encouraged. The findings highlight the need to be non-threatening toward people's psychological needs when making behavioural requests, while suggesting that air pollution may be a particularly useful impact framing to communicate adaptation in the UK. Together, the work suggests a need to go beyond current approaches to communicating adaptation, and at a broader level, shift away from *fear appeals* towards *efficacy appeals*.

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List of Abbreviations

AIC – Akaike's Information Criterion

ANOVA – Analysis of Variance

APA – American Psychological Association

BPS – British Psychological Society

CA – Conversation Analysis

CADM – Comprehensive Action Determination Model

CASPI – Low Carbon Lifestyles & Behavioural Spillover Project

CCC – Committee on Climate Change

CO – Climate Outreach

CLT – Construal Level Theory

DA – Discourse Analysis

DC – Direct Current

Defra – Department for Environment, Food and Rural Affairs

DMC – Disaster Management Cycle

EA – Environment Agency

ECG – Electrocardiogram

EDA – Electrodermal Activity

EER – Environment, Energy and Resilience

ESRC – Economic and Social Research Council

FEMA – Fact, Evaluation, Motivation, Action

GLMM – Generalized Linear Mixed Model

GSR – Galvanic Skin Response

GT – Grounded Theory

HF – High Frequency

HRV – Heart Rate Variability

ID – Interdisciplinary

IPA – Interpretative Phenomenological Analysis

IPCC – Intergovernmental Panel on Climate Change

IPT – Identity Process Theory

ITA – Inductive Thematic Analysis

LMM – Linear Mixed Model

MOCA – Model Optimised for Communicating Adaptation

NAT – Norm-Activation Theory

NFM – Natural Flood Management

NU – Normalised Units

PAR – Participatory action research

PID – Public Information Deficit Model

PMT – Protection Motivation Theory

PRT – Psychological Reactance Theory

SA – Saliency Analysis

SCL – Skin Conductance Level

SCR – Skin Conductance Responses

SD – Standard Deviation

SE – Standard Error

SEM – Social Ecological Model

SIT – Social Impact Theory

SRT – Social Representation Theory

SVT – Schwartz Values Theory

SWDTP – South West Doctoral Training Partnership

TPB – Theory of Planned Behaviour

UoB – University of Bath

VBN – Values-Beliefs-Norms Theory

WI – Womens' Institute

Glossary of key terms

Adaptation: The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm, or exploit beneficial opportunities (IPCC, 2014b: 5).

Adaptive response: Behaviours and attitudes that proactively aim to address the negative impacts of climate change (including mitigation behaviours as part of a reasonable response to climate impacts), and actions that can influence efforts at other scales to minimise climate risks (see *Chapter 1*).

Coping: The use of cognitive and behavioural strategies to manage the demands of a situation when these are appraised as taxing or exceeding one's resources, or to reduce the negative emotions and conflict caused by stress (APA, 2020a).

Coping behaviour: A characteristic and often automatic action or set of actions taken in dealing with stressful or threatening situations. Coping behaviours can be both positive (i.e., adaptive), for example, taking time to meditate or exercise in the middle of a hectic day; or negative (i.e., maladaptive, avoidant), for example, not consulting a doctor when symptoms of serious illness appear or persist (APA, 2020b).

Efficacy: Competence in behavioural performance, especially with reference to a person's perception of their performance capabilities, or perceived self-efficacy (APA, 2020c).

Emotion-focused coping: A stress-management strategy in which a person focuses on regulating their negative emotional reactions to a stressor. Rather than taking actions to change the stressor itself, the individual tries to control feelings using a variety of cognitive and behavioural tools (APA, 2020d).

Environmental communication: (a) A pragmatic tool to educate, alert and persuade people to solve environmental problems [and] (b) the medium which constitutes our way of perceiving and interpreting nature and environmental problems (Klöckner, 2015: 18, drawing on Cox, 2012).

Framing: The process of defining the context or issues surrounding a question, problem, or event in a way that serves to influence how the context or issues are perceived and evaluated (APA, 2020e).

Maladaptive response: Behaviours and attitudes associated with avoiding, denying or exacerbating the impacts of climate change, and/or promoting responses to climate risks that are likely to negatively impact others or the environment (see *Chapter 1*).

Physiological need: Any of the requirements for survival, such as food, water, oxygen, and sleep (APA, 2020f).

Problem-focused coping: A stress-management strategy in which a person directly confronts a stressor in an attempt to decrease or eliminate it. This may involve generating possible solutions to a problem, confronting others who are responsible for, or otherwise associated with, the stressor, and other forms of instrumental action (APA, 2020g).

Psychological need: Any need that is essential to mental health or that is otherwise not a biological necessity. It may be generated entirely internally, such as the need for pleasure, or by interactions between the individual and the environment, such as the need for social approval, justice, or job satisfaction (APA, 2020h).

Social norm: Any of the socially determined consensual standards that indicate (a) what behaviours are considered typical in a given context (descriptive norms) and (b) what behaviours are considered proper in the context (injunctive norms) (APA, 2020i).

Threat: 1. A condition that is appraised as a danger to one's self or well-being, or to a group. 2. An indication of unpleasant consequences used as a means of coercion for failure to comply with a given request or demand. 3. Any event, information, or feedback that is perceived as conveying negative information about the self (APA, 2020j).

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Chapter 1

Introduction

1.1 Introduction

This thesis is about communicating adaptation to climate change. Focusing on the UK context, with particular attention paid to flooding and the health impacts of climate change, this thesis contributes to understanding around (a) the factors that promote adaptive responses to climate change, and (b) how an appreciation of such factors can be translated into the design of more optimal communications about adaptation. By addressing these issues, the thesis also (c) provides recommendations for practitioners seeking to communicate adaptation.

At a broad level, the 'golden threads' that run through this thesis are:

- *'Adaptive responses' to climate change* – Given that climate change is now affecting individuals and communities, a transformative societal response is required to minimise its negative impacts. Particular attention is paid to flooding, given its salience within a UK context. *('Adaptive responses' are defined in this chapter.)*

- *Communications* – A focus on communications interventions that aim to encourage adaptation, and how to ensure individuals respond to communications in adaptive ways.

- *Social psychology* – This work is interdisciplinary, though is conducted primarily from a social psychology perspective. It thus focuses on the 'individual in a social context', the mechanisms that encourage adaptive responses and how communications can do more to harness these factors.

- *'Coping with threats'* – the literature review (*Chapter 2*) highlights that *threat* and *coping* appraisals are fundamental to understanding individuals' responses to both climate impacts and communications interventions.

While primarily working from an environmental-social psychology perspective, this work builds on previous literature in the fields of climate change communication, health communication, human geography and disaster risk reduction. The work also builds on my previous research about climate change communications (McLoughlin, 2012, 2015).

This introductory chapter details the background context of the present work, provides a rationale for the thesis, and explains the approach taken, including key terms and methodology. An overview of the thesis structure, with chapter summaries, is provided at the end of this chapter.

1.2 Background context: Facilitating adaptation to climate change

Climate change is a major international problem socially, politically, and economically (IPCC, 2018), posing the *"biggest global health threat of the 21st century"* (Costello et al., 2009: 1693). Global average temperatures have risen by around 1°C since the pre-industrial period, due increased concentrations of CO_2 and other greenhouse gases, following the consumption of fossil fuels and land use changes (IPCC, 2015).[1] A minimum average global warming of 1.5°C will result in increased severity of climate impacts, while 2°C would be extremely costly for society and human health (IPCC, 2018). Such changes will increase stresses on human and ecological systems from severe flooding, droughts, water scarcity, deadly heat extremes, vector-borne diseases, and hurricanes (IPCC, 2018). Climate modelling shows that, left unchecked, warming is likely to go beyond 2°C (IPCC, 2014a). The scientific basis for climate change has been described as 'unequivocal' by the Intergovernmental Panel on Climate Change (IPCC, 2013). Addressing the threat of climate change now requires rapid and transformative political, cultural and social action (IPCC, 2018).

There is clear evidence that climate change is already affecting the health and livelihoods of human beings around the world (McMichael et al., 2006; Watts et al., 2018). Climate change has increased negative outcomes for human health, including injury and deaths from floods, storms, cyclones and wildfires, changes in disease and microbial proliferation (e.g. salmonella, malaria, dengue), reduced crop, livestock and fisheries yield, loss of livelihoods, displacement, and impacts on mental health (McMichael et al., 2006). According to data from the EM-DAT international disaster database, there were 5,033 deaths and 28,963,414 people affected by extreme heat, extreme cold, storms, floods, droughts and wildfires in 2018 alone (Levitt et al., 2018). The UK faces a range of impacts, including flooding, increasing heat stress,[2] reduced air quality, water scarcity, reduced food security, new and emerging pests and diseases, and negative outcomes for mental health (CCC, 2017; HM Government, 2017; Met Office, 2019; NERC, 2015).

Given the global response to climate change has been limited, some further warming of the atmosphere is seemingly unavoidable. Climate change due to carbon dioxide emissions is largely irreversible for 1,000 years after emissions stop, due to the persistence of greenhouse gases in the atmosphere (Solomon et al., 2009). In turn, the

[1] Since 1970, CO_2 emissions have increased by about 90%. Of the total greenhouse gas emissions, fossil fuel combustion and industrial processes have contributed approximately 78% between 1970 to 2011, with agriculture, deforestation, and other land-use changes being the second-largest contributor (EPA, 2016; IPCC, 2015).

[2] Without action, the number of people dying in the UK as a result of heat is expected to reach 7,000 a year by 2040 (Carrington 2020)

UN has stressed urgency to mitigate climate change (UN, 2019).[3] While there has been some progress in international cooperation, including the Kyoto Protocol in 1997 and the Paris Accord in 2015, commitments to date have been voluntary, meaning no legal mechanisms are in place to ensure targets are met. Furthermore, such agreements continue to face political obstruction, such as the US withdrawal from the Paris agreement (despite being the world's second largest greenhouse gas emitter (EPA, 2016)). Similarly, although there have been many promising responses to climate change amongst civil society and at the city level (see: C40 Cities, 2018); more substantial action is still required. In the UK, while the Climate Change Act (2008) provides one of the most progressive frameworks for responding to climate change globally, the UK has repeatedly failed to put the policies in place that are required to tackle climate change (CCC, 2019). While the government has formally declared a 'climate emergency', becoming the first major economy to commit to net zero emissions by 2050 (BBC News, 2019; BEIS, 2019), officials have conceded that major flooding in the UK is now likely every year, and that not all homes or communities can be saved from climate impacts (Carrington, 2016; Harvey, 2018; Laville, 2019). As government bodies operate under the assumption there may be up to 4°C of global warming (Environment Agency, 2019), severe floods and heatwaves in Britain have been described as the *"new normal"* (Fowler, 2019: npn).

Given some degree of climate change is now unavoidable, efforts must be taken not only to limit climate change, but also to manage the negative outcomes. While every effort to *mitigate* climate change is still crucial (reducing greenhouse emissions), ensuring optimal *adaptation* (reducing and preparing for the negative impacts of climate change) is now of paramount importance. As has been noted, *"the time for rapid adaptation has arrived"* (Xu et al., 2018: 32). Adaptive responses are thus required at personal, political and practical levels (O'Brien, 2018). While government has a responsibility to legislate for, and coordinate, adaptation, members of the public can also take actions to adapt. As noted by Defra, (2018: 5)

> *"Adapting to our changing climate cannot be done by government alone. It will require collaboration across civil society, local authorities, private and public sectors and infrastructure providers"*

Adaptation actions at the personal level can include protection of personal property from flooding, seeking information about impacts like heat waves, taking out insurance, and supporting stronger climate change adaptation policies (van Valkengoed & Steg, 2019b). Such personal-level actions are interdependent with adaptation at broader societal and political levels (as discussed later in this chapter).

[3] A 12 year timescale to limit climate change was widely reported in the media (e.g. McGrath, 2019; Watts, 2018); this narrative has been controversial, used inaccurately and circumnavigates the issues of injustice at the heart of climate change (Allen, 2019).

Yet despite the risks of climate change, adaptation has been limited. Globally, spending on adaptation has fallen drastically short of the $100 billion per year target set out in the Paris Agreement (Watts et al., 2018). Despite recent updates to the UK government's National Adaptation Plan (Defra, 2018), an audit by the Committee on Climate Change (CCC) found that the government did not score well in any of its 33 priority areas in terms of preparing for climate change, or reducing vulnerability and exposure to climate risk (CCC, 2019). At present, 1 in 10 new homes are built in areas that have a high flood risk (Halliday, 2020; Halliday & Barratt, 2020), and this follows sharp spending cuts to flood defences in 2013, under austerity measures (Wren-Lewis, 2020). At the public level, research in the UK has found that adoption and understanding of flood-protection measures is universally very low (Bichard & Kazmierczak, 2012; Soane et al., 2010). The Environment Agency (EA) has reported that of the 5.2 million households at risk of flooding, less than 10% think they are at risk and even fewer have planned how they will respond in the event of a flood (Curtin, 2017). The CCC have reported that the government are not prepared for 2°C of global warming, let alone a 4°C temperature increase (CCC, 2019). While people's capacity to adapt can be influenced by broader structures, institutions and systems, social factors are also crucial to adaptation (Adger et al., 2009; O'Brien, 2018). There is now an urgent need to better understand the drivers and barriers of adaptation behaviours, and to develop effective interventions to facilitate adaptive responses.

In turn, communications can play a key role in facilitating adaptive responses to climate change (Defra, 2018; Klöckner, 2015; Moser, 2014, 2016). A growing body of work in the domain of *climate change communication* addresses the ways that communications can influence people's responses to climate change (Moser, 2010). This past research and practice suggests that when they go beyond simply amplifying information about climate change via one-way information dissemination, communications can be particularly effective (Corner & Clarke, 2017b; Kahan et al., 2011; Soane et al., 2010; Whitmarsh et al., 2013). Communications can influence changes in attitudes and behaviours and can also set the foundation for other adaptation measures to be introduced. In this vein, the CCC has highlighted that *deep public engagement* around adaptation is necessary to help communities cope with climate change impacts (CCC, 2018).

Despite this, communication about adaptation has typically been neglected in favour of mitigation-oriented communication. Analysis has revealed that just two per cent of the newspaper coverage of climate change is dedicated to adaptation (Moser & Boykoff, 2013)[4] and it has been noted that adaptation cannot compete with the drama of other climate narratives (Painter, 2019). Furthermore, when adaptation *has* been communicated, it has often carried negative baggage (Painter, 2014). Al Gore famously dismissed adaptation as a *"lazy cop-out' on fighting the causes of climate change"* (Moser, 2014: 338) and adaptation has been seized upon by climate deniers to justify

[4] This analysis considered coverage in 50 newspapers across 20 countries (between 2004-2012), and looked for explicit uses of the term 'adaptation'.

inaction in terms of mitigation (see: CFR, 2012).[5] Moser (2014: 338) notes that adaptation is often taken to be a *"concession of defeat on mitigation".* For such reasons, adaptation has come to be seen as the *"poor cousin"* of mitigation (Law, 2019: npn), while others have spoken of *"lifting the taboo"* on adaptation (Pielke Jr et al., 2007: 597). Additionally, the CCC has noted that delivery and funding of adaptation focused engagement is currently insufficient to meet the challenges ahead (CCC, 2018).

There is now a clear need to enhance the ways that adaptation is communicated. Past research suggests that communication with the public about adaptation is likely to be enhanced by (a) considering underlying psychological processes liable to help or hinder the uptake of adaptive responses, and (b) considering the psychology of how communications are perceived. However, the current research required to help optimize adaptation and its communications is limited, meaning further study is now required. A research rationale is outlined in the following section.

1.3 Research rationale

Further research about communicating adaptation is now required for two main reasons: (1) *research addressing adaptation behaviour is limited;* (2) *research addressing the communication of adaptation is limited*.

1) *Research addressing adaptation behaviour is limited:*

Whilst there is a clear need for adaptation, the factors that motivate adaptation are still relatively under-researched, compared with factors influencing mitigation and other pro-environmental behaviours. For instance, most of the research in the field of environmental psychology has tended to focus on climate mitigation (e.g. household energy use, sustainable transport and diet), or on other pro-environmental behaviours (e.g. plastic consumption, littering, or conservation behaviour). A literature search of the APA PsycNET database revealed that within the 2,456 returns for climate change, only 407 (16.57%) explicitly refer to adaptation,[6] while a literature search of the Web of Science catalogue revealed that of the 894 entries on the topic of climate change within the research area of psychology, only 83 (9.3%) explicitly refer to adaptation.[7] In addition,

[5] When Rex Tillerson, former CEO of Exxon Mobil and former U.S. Secretary of State, was asked about the impacts of climate change back in 2012, he responded that *"as human beings as a species, that's why we're all still here. We have spent our entire existence adapting, OK? So we will adapt to this. Changes to weather patterns that move crop production areas around – we'll adapt to that."*

[6] An initial search was conducted for peer reviewed articles mentioning "climate change" in any field. A second 'within results' search then refined results by the truncated term "adapt*".

[7] Comparison of two searches, within the advanced search function of Web of Science (apps.webofknowledge.com). Search 1: "Topic [TS]= ("climate change") AND Research Area [SU]= (Psychology)". Search 2: Topic [TS]= (adapt* AND "climate change") AND Research Area [SU]= (Psychology). Topic searches title, abstract, author keywords, and Keywords Plus.

there are clear gaps in the literature focusing on the factors promoting adaptation (as explored in detail in the literature review), and despite a large body of work addressing disaster risk reduction, insights from this field have arguably not been well-integrated into current understandings of adaptation behaviour.

2) *Research addressing the communication of adaptation is limited*:

While research projects and reports about communicating adaptation exist (Corner & Clarke, 2017a; Messling et al., 2015), much of the work about climate change communication has been carried out with the latent assumption that better public engagement with climate change will catalyse greater *mitigation* of climate change (i.e. building support for more stringent policies to reduce greenhouse gas emissions, and personal level climate mitigation actions). Often, adaptation is overlooked, perhaps even forgotten. As Moser (2014) notes, guidance about communicating adaptation is often not available to practitioners, as research specifically focused on communicating adaptation is still in its infancy. The limits of the existing literature will be explored in detail in the literature review *(Chapter 2).* Again, insights about communication could also be better integrated from research surrounding disaster risk reduction, where useful.

This thesis addresses each of these limitations, by investigating the factors that influence adaptation, and considering how these can be translated into, and harnessed by, communications interventions. Addressing these research limitations is expected to deliver a range of new theoretical and practical contributions related to adaptation behaviour and communications. The research implications will also have relevance to policy makers, and others designing adaptation measures. The research aims are clarified below, in relation to this rationale.

1.4 Research aims

Given adaptation behaviour, communication of adaptation, and research on this topic are all limited; this thesis responds to three simple, overarching aims:

1) *To advance knowledge about the factors that influence adaptation behaviour.*

2) *To advance knowledge about how communications can be optimised to promote adaptation.*

3) *To provide clear recommendations for practitioners who communicate with the public about adaptation.*

The following section provides specific details about the approach taken to this thesis work.

1.5 Research approach

1.5.1 Climate change from a psychological perspective

Climate change has been described as a *"wicked problem"*, given its wide-reaching implications for human societies (Doherty & Clayton, 2011: 265), which necessitate responses from myriad research perspectives within scientific, political, technological, economic and socially oriented disciplines. While climate change requires a multifaceted, collective response, a psychological perspective is of fundamental importance. Climate change and human psychology are intrinsically linked, which can be observed in four key ways.

Firstly, this may be true in a physical sense. Research on human evolution has argued that the development of the human brain may have been a response to climate variability in the Great Rift Valley, which drove hominin *speciation* (formation of new and distinct species), *encephalization* (increase in brain size and complexity) and *dispersals* (i.e. migration) out of Africa (Maslin et al., 2015; Shultz & Maslin, 2013). Secondly, if one accepts that behaviours and practices are in some way linked to human mindsets, whether autonomous or not (i.e. that people's attitudes or values can motivate their behaviour – e.g. Ajzen, 2011; De Groot & Thørgerson, 2013; Schwartz, 1977), then one must also accept that human mindsets facilitated the onset of manmade climate change. In other words, that the hegemonic desires, attitudes, values and goals, which gave rise to the industrial revolution, proliferated the consumption of fossil fuels.

Thirdly, climate change can impact the human mind. There is now clear evidence about how climate impacts can lead to negative outcomes for both mental health and physical health (Doherty & Clayton, 2011; Foudi et al., 2017; McMichael et al., 2006; Waite et al., 2017). A clear example here is the rise in 'climate anxiety' (Ray, 2020). And finally, the study of climate-relevant attitudes, behaviours and practices is a rapidly growing area of psychological research. Climate change poses a toxic combination of biases in terms of human psychology (Gifford, 2011; Marshall, 2014, 2015). Much research in the past few decades has been dedicated to the psychology of climate perceptions, biases, heuristics and behaviours that influence and limit climate action (as is discussed in the literature review). Symbolising psychology's key role, the American Psychological Association (APA) established the *Task Force on the Interface Between Psychology and Global Climate Change* (APA, 2009).

In turn, psychology is well positioned to help address the challenges of climate adaptation. This thesis operates from a social psychology perspective, which treats the unit of focus as the *individual within a social context.* From this perspective, the research aligns with other recent efforts in seeking to explain how people adapt to climate change, and to understand and evaluate responses to interventions (e.g. van Valkengoed & Steg, 2019b). This perspective is useful for approaching adaptation, especially when conceptualising the individual as existing in a dynamic relationship with the social environment, as conceptualised in Social Ecological Models (see *Figure 1.5.1*; Bronfenbrenner, 1978). Similarly to O'Brien's (2018) model, which highlights a synergy

between *personal*, *political*, and *practical* climate responses, this perspective accepts that individual behaviour can be shaped by factors such as public policy, community and interpersonal relationships, but also accepts that individual behaviours can shape and influence each of these layers as well. As explored in the literature review (*Chapter 2),* the position adopted here thus goes beyond commentary suggesting a binary distinction between behaviour change and systems change (e.g. Mann, 2019) – instead accepting that substantial transitions around climate change will involve both. While Bronfenbrenner's social ecological model is not the primary model of human behaviour examined in this thesis, it is certainly a useful way of conceptualising and locating, at a broad level, the individual within a dynamic social environment – and this model will be referred to at times within the thesis.

Figure 1.5:1 *- The Social Ecological Model, adapted from (Bronfenbrenner, 1978); from: e-Source, (2018:npn).*

Nevertheless, while this thesis approaches the topic of climate change adaptation primarily from a position of psychological inquiry, it also willingly draws on other disciplinary insights (see *Section 1.5.4*). This is also typified in the following section, which explores different perspectives on the meaning of adaptation, to formulate a psychological position that remains inclusive of other disciplinary perspectives.

1.5.2 Adaptation from a psychological perspective

Adaptation occurs at a range of levels, including the international level (e.g. cross-governmental adaptation plans), the national level (e.g. national government adaptation policy), the regional and local level (e.g. local government and delivery bodies

implementing adaptation measures), the community level (e.g. groups that act to promote greater local adaptation) and the individual level (e.g. taking personal actions to adapt or promote adaptation). *Adaptation* has been defined by the IPCC (2014b: 5), as:

> *"the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities"*

However, adaptation remains a complex concept, with several distinct implications. *Incremental adaptation* is the gradual adjustment to environmental changes, largely maintaining existing practices, while *transformational adaptation* concerns radical systemic changes, with substantial adjustments to practices, policies or values (Kates et al., 2012). *Planned adaptation* typically refers to policy-level decision making, planning and delivery by government and institutions (Sherman et al., 2016; Westerhoff et al., 2010), while *autonomous adaptation* refers to adaptive actions without the intervention of the state or other public bodies (Leclère et al., 2013). Adaptation in each of these senses can be increased in preparation for (*anticipatory adaptation*), or in response to (*reactive adaptation*), impacts generated by a changing climate. Reactive adaptation is arguably more likely, as research has shown the importance of "evolving social contracts" as a mechanism driving adaptation (Adger et al., 2012). This work highlights that, rather than a smooth process, adaptation occurs as a set of policy and planning crises in response to impacts – meaning consensuses and expectations about the role of the state and its responsibilities are challenged through interactions between individual, state and policy actors. In the social sciences, adaptation may also refer to both *adaptive capacity* (an individual's, group's or organisation's ability to adapt to changes), or *adaptation decisions and implementation* (i.e. transforming adaptive capacity into real world actions) (Adger et al., 2005). Recently, the term *deep adaptation* has been used to emphasise adaptation as a process of dealing with the loss, trauma and tragedy associated with the climate crisis, while accepting the possibility of large scale societal collapse (Bendell, 2018).[8]

Adaptation can also be contrasted with *maladaptation*; defined by Barnett and O'Neill (2010: 212) as:

> *"action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups"*

Maladaptation can be broken down into five levels (Barnett & O'Neill, 2010). Actions can be considered maladaptive if they (1) increase emissions of greenhouse gases (e.g.

[8] Work on *Deep Adaptation* argues for greater consideration about *Resilience* ("how do we keep what we really want to keep?"), *Relinquishment* ("what do we need to let go of in order to not make matters worse?") and *Restoration* ("what can we bring back to help us with the coming difficulties and tragedies?"). It should be noted however, that this term is controversial, and stems from work that has not been peer-reviewed.

using energy intensive air conditioning to minimise the health impacts of a heatwave), (2) disproportionately burden the most vulnerable (e.g. placing a desalination plant close to a poor community who oppose it, increasing water prices), (3) have high opportunity costs (e.g. opting for solutions that have greater negative social, environmental or economic costs than alternatives), (4) reduce incentives to adapt (e.g. undermining water consumption reductions from behavioural change by providing desalination infrastructure), and (5) set paths that limit the choices available to future generations (e.g. committing to ineffective engineering infrastructure projects that require large economic input for generations). Despite the threat of climate change, human behaviour is not guaranteed to reduce its negative effects and may counterintuitively increase risks to oneself and others.

In the psychological and health sciences, behaviours which are considered to be 'adaptive' or 'maladaptive' are conceptually different to the climate change-focused definitions above, and are less frequently cited within the climate literature (Reser & Swim, 2011). Definitions of adaptation in evolutionary psychology, for instance, often follow a Darwinian formulation, referring to that which provides a genetic advantage, reproductive success and greater chance of survival. Adaptive behaviour in this sense is that which enables appropriate and effective adjustment to the environment (APA, 2018).

However, in the health psychology and environmental stress literature, adaptive responses are typically related to 'coping'. *Coping behaviours* are actions which aim to minimise stressful or threatening life events (APA, 2020a). Coping can occur in response to threats towards *physiological needs* that are essential for survival (e.g. food, water, shelter) and in relation to *psychological needs* (e.g. needs that are important to mental health, such as social approval, pleasure and self-esteem) (APA, 2020c; Maslow, 1943). Two broad forms of coping strategy are often distinguished. *Problem-focused coping* is when an individual directly confronts a stressor, aiming to decrease or eliminate it (APA, 2020b). This is contrasted with *emotion-focused coping*, whereby an individual does not take actions to change the stressor, but instead manages their negative emotional reactions to the stressor (Lazarus, 2006; Lazarus & Folkman, 1984). Typically, in the health communications literature (e.g. Maddux & Rogers, 1983; Witte & Allen, 2000), problem-focused coping is viewed as adaptive (especially when the behaviour is aligned with the recommendations of experts), while certain types of emotion-focused coping, like avoidance or denial, are seen as maladaptive.

Following these points, adaptation can be investigated at the individual level as adaptive responses which involve *problem-focused coping with the threats posed by climate change* (see *Figure 1.5.2*). Adapting to the threat of climate change can be viewed as sharing similarities with the ways that individuals would cope with a personal health problem, such as cancer, smoking, or liver failure. Given the health impacts of climate change described earlier, this is not a great leap to make, and for this reason, literature related to health communications will be drawn on throughout this research. While not a key focus of this work, to ensure consistency with previous literature, this research will distinguish between emotion-focused coping that is adaptive and non-avoidant (e.g.

processing emotions in ways that support problem-focused coping, seeking support), as opposed to maladaptive and avoidant (e.g. denying climate change, downplaying risks, fatalism, avoidance) (Gifford, 2011; Hamilton & Kasser, 2009; Lazarus, 2006). This distinction is illustrated in *Figure 1.5.2*.

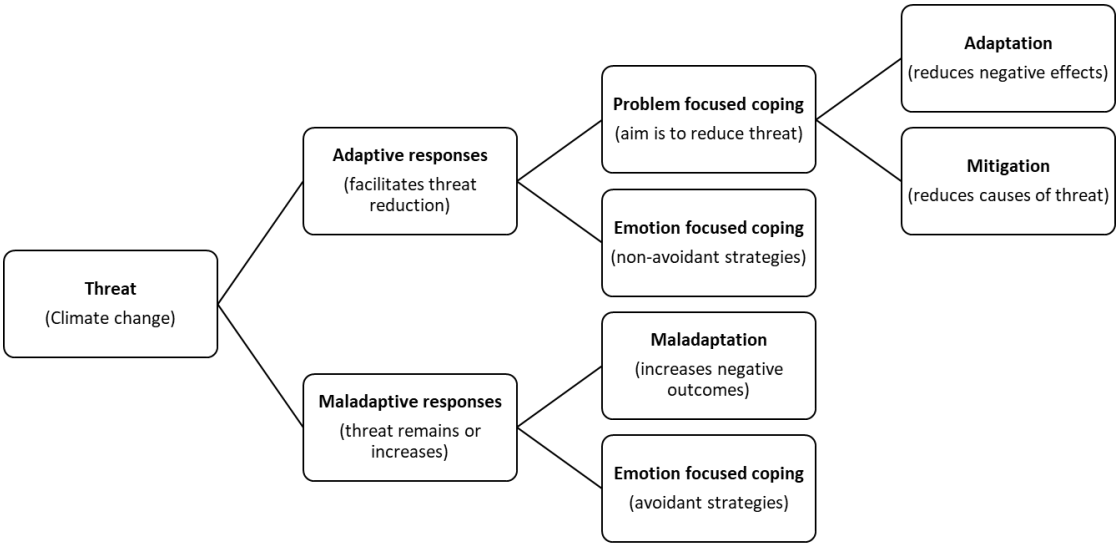


Figure 1.5:2 *- Schematic showing possible adaptive and maladaptive coping responses to climate change.*

Defining adaptation as a form of 'coping with environmental stress' is favoured by the APA (APA, 2009), and fits with a social psychological definition of adaptation as behaviours that are aimed at avoiding or reducing the negative impacts of climate change (van Valkengoed & Steg, 2019b). It can be viewed as an individual level framing of the IPCC's (2014b: 5) perspective of *resilience*, which is achieved through adaptation, being the "capacity of social, economic, and environmental systems *to cope* with a hazardous event or trend or disturbance". Furthermore, this framing is well suited to the focus on communications in this thesis. Reser & Swim (2011) note that viewing adaptation as a form of coping helps to integrate research about environmental perceptions and communications, along with risk management and disaster preparedness. Conceiving of adaptation as a form of coping response thus allows analysis to simultaneously consider how individuals respond to (a) the threat of climate change itself, and (b) the potential threat posed by interventions, like communications. This point is developed further in the literature review (*Chapter 2).*

An additional benefit of conceiving of adaptation in terms of coping is that it allows mitigation behaviours to be considered as part of a reasonable set of 'adaptive responses', alongside adaptation (see *Figure 1.5.2*). Typically, in climate research and policy literature, mitigation and adaptation are considered as separate, yet complementary, processes (IPCC, 2014c). The integration and coordination of adaptation and mitigation is nevertheless viewed as essential, as no single measure is

sufficient alone (IPCC, 2014a). However, this treats adaptation in a narrow sense, and it has been argued that the prevailing distinction between adaptation and mitigation is problematic when studying people's actions and motivations from a psychological perspective (Pielke et al., 2007; Reser & Swim, 2011). Breaking down the duality by viewing mitigation actions as part of a holistic set of adaptive responses is perhaps therefore more reflective of how civil society engages with climate change (Corner et al., 2020). For instance, research has suggested that individuals may take mitigation actions in response to first-hand experience of flooding (Spence et al., 2011), while other work has highlighted the overlaps between factors promoting mitigation and adaptation – and argues the need for a common model of climate behaviour (van Valkengoed & Steg, 2019a, 2019b).

Finally, a conceptualisation of adaptation as a form of 'coping' can be viewed as complementary to the Social Ecological Model (see *Figure 1.5.1* above; Bronfenbrenner, 1978). As noted, adaptation (and mitigation) occurs at a range of levels. While individuals can adapt at the personal level, they can also influence adaptation at the community and policy level. And, conversely, policy, communities and organisations can all facilitate or constrain adaptation. Acknowledging this is also important, as it has been noted that the success of adaptation can be conceived of either in relation to, or independent of, its scalar context (Adger et al., 2005).

Henceforth, the terms *'adaptation'* and *'adaptive responses'* will be used interchangeably to refer to:

> "*behaviours and attitudes that proactively aim to address the negative impacts of climate change (including mitigation behaviours as part of a reasonable response to climate impacts), and actions that can influence efforts at other scales to minimise climate risks".*

The terms maladaptation and maladaptive, following Barnett and O'Neill (2010), will be used interchangeably to refer to:

> *"avoiding, denying or exacerbating the impacts of climate change, and/or promoting responses to climate risks that are likely to negatively impact others or the environment".*

These definitions allow blending of the literature from the psychological science, climate and communications disciplines. *Table 1.5.1* below provides some illustrative examples of adaptation actions. This is not an exhaustive list, but is useful to help clarify what adaptation may look like in real terms.

Table 1.5:1 *- A typology of adaptive behaviours that individuals and households can undertake (adapted from van Valkengoed & Steg, 2019: 5). This table has been adapted to include mitigation actions to be part of a set of reasonable 'adaptive responses' to climate impacts. Note that this does not include actions occurring at other levels (e.g. actions taken by policy makers, or community leaders). This typology is oriented toward actions that may be anticipated in developed, western nations, and is non-exhaustive.*

Type of adaptive behaviour	**Description**	**Examples**
Information seeking	Expending time and effort to gain more information about specific climate related hazards, to identify whether you are at risk of a hazard, and gaining information on which actions to perform successfully to adapt to climate change	Studying weather forecasts, using flood maps, looking up information on how to flood-proof the house, reading government brochures on preparedness, listening to the radio during a climate-related hazard
Preparative actions	Structural actions taken before the onset of a climate-related hazard aimed at reducing the probability of being affected by a hazard or minimising its negative impact	Boarding up windows before a hurricane, installing valves with back-flow prevention, cleaning gutters, storing non-perishable foods
Protective actions	Actions taken during an ongoing climate-related hazard to avoid or reduce its impact	Defending the home against wildfire, not driving through floodwater in a vehicle, staying indoors during a hurricane, staying cool during a heatwave
Evacuation	Temporarily moving away from an area to avoid the negative impacts of a climate-related hazard; may also include leaving an area permanently if required	Complying with government-issued evacuation recommendations, planned retreat, migration (e.g. short duration, long term, or permanent)
Purchasing insurance	Purchasing an insurance policy that covers losses from one or multiple climate-related hazards	Flood insurance, wildfire insurance, homeowner insurance
Political actions	Influencing local or national governments to implement adaptation (or mitigation) policies	Voting in favour of adaptive policies, protesting, participating in town hall meetings, forming an action group, signing a petition
Mitigation actions	Taking action to reduce one's personal carbon footprint to help minimise the negative impacts of climate change	Reducing household energy consumption, using sustainable transport options, reducing meat consumption

1.5.3 Communications from a psychological perspective

It is also worth noting how the term *communications* will be conceptualised within this thesis. From a psychological perspective, Klöckner (2015: 18), draws on Cox (2012), to define 'environmental communication' as:

> *"(a) A pragmatic tool to educate, alert and persuade people to solve environmental problems and as (b) the medium which constitutes our way of perceiving and interpreting nature and environmental problems".*

In these terms, environmental communication can be *direct person-to-person* (e.g. a family conversation, group discussion, or a lecture), *mediated person-to-person* (e.g. email, phone messages, video calls or similar services), and via *media* (e.g. books, newspaper, TV, radio, internet, and also artwork, music and theatre) (Klöckner, 2015). Nevertheless, as is typical within the field of climate change communication, the focus of this thesis is more concerned with the underlying mechanisms and principles that influence individual level perceptions of climate change and its communication. This means the implications of this research could reasonably be extrapolated to a range of modes of communications (unless discussed explicitly). Please also note, the terms 'communication' and 'public engagement' are used interchangeably, until returning to this issue in *Chapter 8*, where participatory communication approaches are discussed.

Communications can be viewed as influencing individual's engagement with adaptation on three key levels: the *attitudinal level* (i.e. people's perceptions, opinions and beliefs), the *behavioural level* (i.e. the actions individuals take), and the *affective level* (i.e. people's feelings and emotions) (Lorenzoni et al., 2007; Whitmarsh et al., 2013). Communications are also viewed as having multi-directional influences on climate adaptation. Relating this back to the Social Ecological Model (*Figure 1.5.1*; Bronfenbrenner, 1978), communications can be viewed as being received at the individual level, in exchange with other levels. For instance, communication to individuals about adaptation can come from government bodies and councils (policy level), non-state actors, groups and bodies (community and organizational levels), or from other individuals, including friends, family and neighbours (interpersonal level). In turn, while communications can influence the individual, as noted above, individuals can also communicate with and influence adaptation at other scales, such as the community level, and policy level. For instance, an individual may be instrumental in establishing a flood action group with members of their community, and then lobby their local council for better flood defences.

This fits well with the idea that communications not only influence small scale behavioural changes (i.e. personal level adaptation), but also large-scale societal changes (i.e. planned or transformative adaptation). Classic psychology research has demonstrated that individuals can influence and be influenced by larger social groups (Asch, 1951; Moscovici, 1974), helping to explain why social movements can influence policy direction. Moreover, a range of social tipping points are thought to exist for climate change, whereby small changes in social systems (including norms and values,

information exchange, and education) can catalyse rapid, wide-reaching changes in the broader system (Otto et al., 2020). One study, for instance, found that a committed minority of around 25% is sufficient enough to tip a broader population into adopting a new social norm (Centola et al., 2018). These points are elaborated further in *Chapter 2*. This contextualisation is important, though the focus on the thesis is on how individuals respond to communications, and the factors that may make people engage with adaptation, rather than explicit analysis of whether individuals go on to influence the wider social environment.

1.5.4 Interdisciplinarity

This work is carried out as part of the interdisciplinary *Environment, Energy and Resilience* (EER) pathway within the South West Doctoral Training Partnership (SWDTP). *Interdisciplinary* (ID) research *"integrates perspectives and methods from two or more disciplines to investigate a topic or an issue"* (Given, 2012: 1). This can be distinguished from *multidisciplinary* research, where a common problem is addressed from different disciplinary perspectives, but there is no integration of concepts or methods (Given, 2012). This research achieves interdisciplinarity in several ways.

Firstly, the project's interdisciplinarity is reflective of my own training and academic pathway to date. Prior to this doctoral research, I completed a degree in Geography, a diploma in Psychology; then and an interdisciplinary MRes, based in the Psychology department at Bath – each stage focusing on climate change communication. I also gained experience working on ID climate change projects in a research assistant role.

Secondly, the present research is situated in interdisciplinary fields. Both *climate change communication* and *climate adaptation* are interdisciplinary areas, comprising researchers from a broad range of disciplines, including psychologists, geographers, and other social scientists. Thus, as noted above, while the focus of this work stems from a social psychology perspective, the thesis also draws on literature from other fields, for instance, from human geography and political science, and from interdisciplinary fields, such as climate change communications, health communication, and disaster risk reduction (DRR). Furthermore, this research has been informed by an ID supervisory team throughout, with expertise in both psychology and geography.

Thirdly, a key part of this research project was a placement with Climate Outreach, which involved collaboration with experts from a range of backgrounds, many outside academia (see *Chapter 8*).

Finally, I have also taken advice from experts at the University of Bath on communicating ID research, and every effort has been made to write up the research in a way that does not require specific disciplinary knowledge, such that the work is accessible for interested readers from any background.

1.5.5 Epistemology and ontology

Given the application of mixed methods, the *epistemology* (theory of knowledge) *and ontology* (theory of reality) of this thesis balances two quite distinct sets of perspectives, associated with qualitative and quantitative research. The qualitative work operates from an epistemological perspective of *interpretivism*, which considers the *meaning* of social phenomena to be the focus of interest, and accepts that individuals experience the social world in unique ways (Bryman, 2012). The qualitative-interpretivist research is conducted from a social constructivist ontology, which assumes that knowledge and meaning are not separate from social actors but are continually produced by social entities. Given this, I also consider that this necessitates a *subjectivist* standpoint which acknowledges that researchers are intrinsically biased by their experiences and worldviews (Trochim, 2006), given that the *"personal is political"* in the identification and production of knowledge (Jackson, 1999: npn). This is most explicit in *Chapter 8*'s participatory action research, in which the relationship between researcher and knowledge is viewed as a dualism that is continually restructured, and reflexive. Therefore, the thesis acknowledges that researchers can influence and reshape the theory they observe (Reason & Bradbury, 2001).

Conversely, the quantitative and experimental work is conducted from a *positivist* standpoint. Positivism considers social truths to be separate from social actors, and accepts that such truths can be directly observed and measured – meaning that methods such as surveys and lab experiments are viewed as measuring, quite literally, social truths (Bryman, 2012). The ontology of this quantitative-positivist research is therefore *objectivist*, as social data is considered to directly represent external truth. Appropriately integrating a positivist-objectivist stance with contrasting perspectives may appear challenging and controversial, yet it is a normal part of mixed methods research (Bryman, 2006). More specifically, it may be appropriate to consider the quantitative work as 'post-positivist', which acknowledges that positivism can be conducted from a non-neutral starting positionality (Trochim, 2006). Such a position acknowledges that the researcher can themselves have opinions, biases, and perceptions which have led them to conduct such research in the first place. This allows me to be reflexive of the irony that although I am conducting positivist work, this is in some way a result of my own concern about climate change, and my opinion that communications require improvement (irony which is doubled by acknowledging that these subjectivities have largely been informed by reading positivist science). Furthermore, it also would acknowledge that the findings of positivist research, though more objective, can then feed back into the social reality (for instance, by influencing communications), which could hypothetically then be measured and observed again. In many ways, this integrated perspective aligns with the Social Ecological Model above (*Figure 1.5.1;* Bronfenbrenner, 1978) – as it accepts that each individual influences, and is influenced by, their social environment. Furthermore, this makes sense given the subject area of this thesis, as it has previously been noted that the concerns of researchers and campaigners have fed into research about communicating climate change (Corner et al., 2014).

Finally, it should be briefly noted that this is a highly *applied* research project. Applied psychology research has been criticized for emphasising practical insights at the expense of theoretical development (Hill, 2006). However, this position is wholly rejected in relation to this work. While the focus of study is on communicating climate change adaptation, this applied context can be viewed as a microcosm of broader human behaviour. Studying adaptation can thus be a window through which a researcher can understand many aspects of peoples' behaviour, potentially telling us something fundamental about human psychology. Yet, simultaneously, given the global scale, complexity, and wide-reaching implications of climate change, it is also a macrocosm, allowing insights into broader human structures and systems. It is thus no limited arena for theoretical reflection. Any new theoretical insights generated can potentially be extrapolated to other domains of human behaviour. Thus, care has been taken to develop theoretical insights as well as practical insights, and to highlight where findings may be abstracted from the research context.

1.5.6 A note on methodology

Given the complexity of the field and disciplinary perspectives that can be drawn on, a range of different methodologies are helpful when exploring adaptive responses to climate change and its communication. At a broad level, the two main forms of psychological analyses are *quantitative* (i.e. statistical and experimental) and *qualitative* (i.e. interpretive, discursive and experiential). Some researchers have purist views about which approaches are most valid in psychological research. For instance, Carl Jung famously critiqued that *"anyone who wants to know the human psyche will learn next to nothing from experimental psychology"* (Jung, 1966: 246). Yet, the two approaches have discrete differences, and unique advantages, in terms of validity and the insights that they can offer. Quantitative methods, such as surveys and experiments, typically involve analysis of large sample sizes to identify broad and generalizable trends (thus offering '*external validity*'), and experimental methods allow for cause and effect to be observed and manipulated (also known as *'internal validity'*; Bryman, 2012). On the other hand, qualitative research is more akin to examining and understanding the intricacies of social meaning and interaction. In this sense, such analyses may be seen as offering greater applicability to real life *('ecological validity'*) than some quantitative methods (Bryman, 2012),[9] and (ideally) offer *trustworthiness*, *credibility* and *transferability* (Lincoln & Guba, 1985).

Mixed methods is an moderate, integrative approach to research which combines both qualitative and quantitative approaches into a research project, thus rejecting their analytical dualism (Bryman, 2006, 2012; Johnson & Onwuegbuzie, 2004). The use of mixed methods carries some controversies. For instance, it has been suggested that mixed methods favour post-positivism over other stances, relegating qualitative research to a lesser role (Creswell, 2011). However, a fundamental benefit of mixed methods,

[9] Nevertheless, note that quantitative methods can also offer good ecological validity, especially in highly applied research contexts (Bryman, 2012).

viewed as essential to the aims of this work, is that they allow for greater *triangulation.* This means applying a range of approaches to allow for a deeper understanding of the topic, and observing patterns across research findings to increase the robustness and validity of the research (Bryman, 2006, 2012; Lieber & Weisner, 2010). While an emphasis is placed on quantitative work in this thesis, qualitative work (e.g. *Chapter 3*) is viewed as instrumental to developing the basis for further quantitative work *(e.g. Chapters 4, 5 & 6).* Qualitative insights are also drawn on to further unpick quantitative findings (e.g. *Chapter 7*), before qualitative reflexive work is returned to at the end of the empirical work (*Chapter 8*). Additionally, from a personal perspective, mixed methods were viewed as offering a more rounded training experience, and opportunity to acquire a range of research skills, with an emphasis on post-positivist psychology.

The process of mixed methods is often iterative, meaning that the cycle of research moves through discrete stages, feeding back from one into another. Teddlie & Tashakkori, (2012: 781) explain that:

> *"The cycle [of mixed methods research] may be seen as moving from facts or observations (grounded data or results) through inductive logic to general inferences (theory or abstract generalizations), then from those general inferences (or theory) through deductive logic to tentative predictions or hypotheses related to outcomes or results."*

This iterative approach is employed within this thesis (as observable in the thesis structure outline below). The background context and the opening exploratory work form tentative hypotheses that are interrogated through the investigative work and experimental approaches, and results are then critiqued through applied participatory methods. In this sense, the project may also be considered as a form of 'evaluation research', given that it aims to improve the design, conceptualisation and practice of an intervention, on an iterative, step-by-step basis (Rossi et al., 1993).

While literature gaps are identified in the literature review (*Chapter 2*), due to the incremental nature of this thesis, research questions are conceptualised on a study-by-study basis, rather than establishing a set of questions and hypotheses *a priori*. This allows the flexibility to build, chapter-by-chapter, from one set of findings to the next, allowing room for the thesis to evolve with a threaded narrative (Walker, 2015) and is similar to other recent theses in the psychological sciences (e.g. Thomas, 2014). This approach is consistent with Alvesson & Sandberg, (2013), who note that empirical findings can encouraged re-readings of the literature, and prompt different ways of engaging with the research issues at hand, and the formulation of new research questions. This perspective is grounded in the position that the formulation of research questions is often not a result from one specific source but one from an interaction between multiple sources – including society, personal experience, existing scientific literature and empirical material (Alvesson & Sandberg, 2013). In this way, the aims of the research were fixed early in the research process, and research questions were devised with a view to these and to the cumulative findings of the thesis so far.

Due to this, each empirical chapter employs a 'bottom up' selection of methods, allowing the most appropriate methodology to be chosen and applied. Given the range of methods utilised (interviews, surveys, physiological lab experiment, online experiments, participatory action research) this thesis does not contain a methodology chapter, but will discuss and contextualise the methodologies within each individual chapter. Research ethics were therefore also considered on a case-by -case basis.

1.5.7 A note on terminology

Given this research concerns communication, it is important to note that the terms and phrases used in positivist psychological research can seem cold and insensitive. Terms such as *manipulation*, *controlled*, *experimental*, and *deception* are common parlance in this area. It must be noted that these terms are used as accurate terminology within the specific context of positivist psychology research, where the aim is to remove confounding factors, biases, and facilitate hypothesis testing. Furthermore, terms such as *adaptive*, *maladaptive*, and variations of the word *threat* (e.g. *threatening communication*) have specific academic meaning in this work. In no way does their use in this document means such terms are being advocated for use in other contexts, given their likely negative connotations if not fully explained. This is especially true for real-world climate communications practices, even if informed by the results of this research.

1.6 Thesis structure and overview

The general structure of this thesis consists of nine chapters (including this introduction), divided into five sections that reflect different research stages of the PhD, and evolve incrementally. These chapters respond to the four aims of the thesis, detailed at the start of this chapter. *Figure 1.6.1* illustrates this structure.

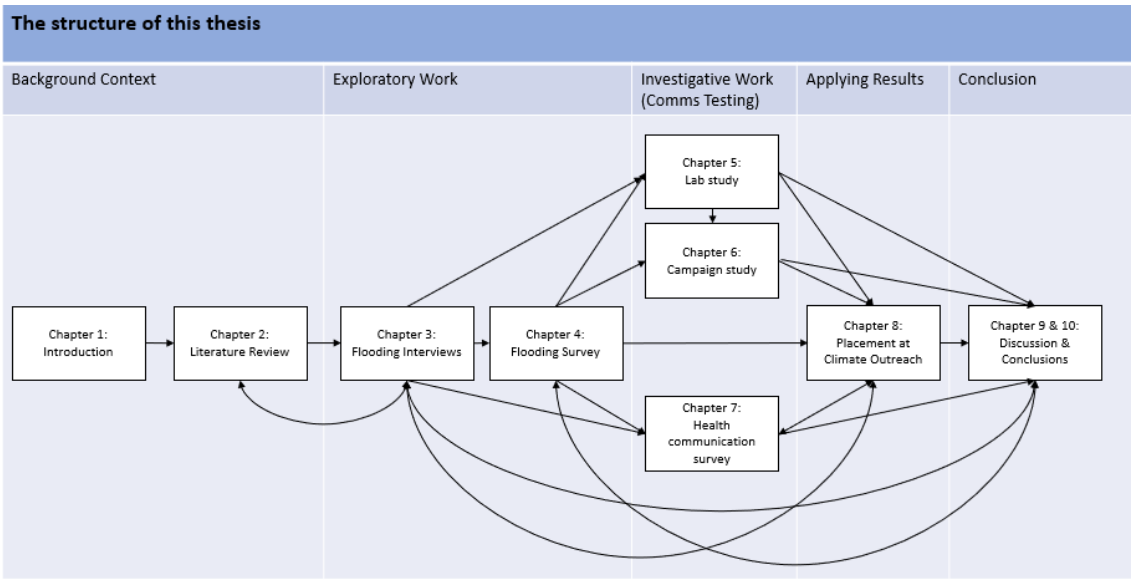


Figure 1.6:1 *- Schematic illustrating the structure of this PhD thesis. Boxes represent chapters and subject areas in the thesis. Arrows represent links between chapters, illustrating how each chapter influenced the creation of another.*

Part 1 – Background context

Chapter 1 (this chapter) introduces the thesis scope on the psychology of communicating adaptive responses to climate change, providing a rationale for the research and definitions of key terms such as 'adaptation' and 'communications'. *Chapter 2* reviews the relevant literature, highlighting the cross-cutting, yet under-researched, roles of *threats* and *coping* responses in determining both climate change adaptation, and responses to climate change communications; and considers the most relevant theoretical frameworks, including Protection Motivation Theory (PMT; Rogers, 1975).

Part 2 – Exploratory work

Chapter 3 presents in-depth exploratory interviews with residents affected by the 2015/16 winter floods in Cumbria (N=14). The psychological need for 'efficacy' is found to be highly salient. Yet engagement around flooding may, in some cases, inhibit efficacy and facilitate maladaptive responses. A follow up survey in *Chapter 4* (N=279) finds that different forms of efficacy ('self', 'response' and 'collective') influence responses at three distinct levels ('personal', 'policy' and 'social', respectively). The studies also raise questions about how (a) 'majority status' may influence responses to communications, and (b) how different impact framings may influence risk perceptions of climate change – leading to a fork in the thesis structure.

Part 3 – Investigative work (communications testing)

Building on the previous studies, the thesis now follows two lines of experimental enquiry. Firstly, *Chapter 5* uses a psychological lab experiment (N=92) to test at an abstract level how 'majority status' may offer protection from a critical communication intervention, via a 'divisional' effect. *Chapter 6* follows up with an online experiment (N=190), finding that when participants perceived their behaviours to have 'minority status', their responses to persuasive communication were more favourable. However, a non-threatening message style was found to be the most influential factor for facilitating adaptive responses.

Secondly, *Chapter 7* uses a survey with a nationally representative sample (N=1,003) to assess how different health framings of climate change influence threat and coping responses. This survey finds that for the UK general public, framing climate change in terms of its impacts on air quality aroused heightened threat and coping responses.

Part 4 – Applying results

Chapter 8 explores the opportunities and challenges of applying findings from this thesis in real-world climate change communications. The chapter presents a portfolio of action research experiences, following an academic placement at the charity Climate Outreach, and provides recommendations for collaborative engagement aiming to nurture efficacy beliefs.

Part 5 – Conclusion

Chapter 9 discusses the key theoretical and practical contributions of the thesis in relation to existing work. Overall, it is highlighted that, across the thesis, the balance of threat and efficacy appraisals, and non-threatening communications approaches, are particularly influential for promoting adaptive responses. The findings of this thesis are brought together as an adapted version of the Protection Motivation Theory model, and recommendations for climate change communications are discussed. *Chapter 10* then concludes the work, reflecting on its strengths, limitations and impact, and provides an agenda for further research.

1.7 Conclusion

This introductory chapter has outlined the focus of this research about *using psychological insights to facilitate adaptive responses to climate change through communications*. The chapter has explained how adaptation and communications will be conceptualised; it has also provided details of the methodological approach and the structure of the thesis. The next chapter considers the factors that influence climate adaptation in detail, reviewing the existing research literature about adaptation behaviours and communicating adaptation.

Chapter 2

Literature review

Image: "Friends of Merri Creek tree planting at Fawkner" by John Englart licensed under CC BY-SA

2.1 Abstract

What are the key psychological factors that promote adaptive responses to climate change and how can communications address these? This literature review responds to this question, drawing especially on literature from social psychology, climate change communications, disaster risk reduction and health communications. This review highlights that the interactions between 'threat' and 'coping' appraisals are key to promoting adaptive responses to climate hazards (i.e. actions aimed at reducing the negative impacts) and also in determining *responses to communications* (i.e. how people respond to messages, narratives and attempts at persuasion). Several types of threat and coping variables are considered in the past literature, including risk perceptions, experience, efficacy and social norms, and there are different theoretical models addressing these factors. Yet, some factors are less consistently able to explain adaptation behaviours, and existing theoretical frameworks have clear limitations. It is argued that to better understand how to optimise communications to promote climate adaptation in the UK and beyond, research must consider explanatory factors in greater detail, as well as provide clearer recommendations for practitioners about how to frame communications. This literature review is illustrative rather than exhaustive and was developed at the same time as the exploratory study, presented in *Chapter 3*. Therefore, each of these scoping exercises should be considered as complimentary in that they each aided the identification of salient factors, issues, initial hypotheses and research questions.

Highlights

- 'Threat' and 'coping' factors can influence responses to both climate change impacts, and communications interventions.
- By 'framing' climate change in ways that harness key psychological factors, communications may be enhanced.
- Factors promoting adaptation include *threat appraisals* (risk perception, experience, negative affect), *coping appraisals* (efficacy, perceived costs) and *other factors* (social norms, values, trust and place attachment).
- Communications factors include *threatening vs. non-threatening message styles*, use of *imagery*, and *co-production*.
- A range of models are relevant to explaining adaptation, especially Protection Motivation Theory (PMT) - yet existing models are limited, and most do not provide clear recommendations for communicators.

2.2 Introduction: Using communications to promote adaptive responses to climate change

This research concerns the facilitation of adaptive responses to climate change, of which *behaviour change* is an intrinsic aspect. Behaviour change refers to the modification of peoples' actions. Some argue that behaviour change cannot address the complexities of climate change. While recent COVID-19 lockdown measures gave rise to major changes in environmental behaviours, reducing demand for coal and oil; this has only equated to an 8% decrease in global emissions for 2020 (IEA, 2020). Some climate scientists have thus argued that lifestyle changes are insufficient to tackle climate change (see commentary by Gavin Schmidt, in Osaka, 2020). Others have highlighted that behaviour change interventions, such as nudge approaches (where behaviour is influenced passively via subtle changes to decision making environments), overly 'individualize' the issues at hand, and cannot build community resilience to climate impacts (Barr & Woodley, 2019).

However, the IPCC considers behaviour change, and behaviour change interventions, to be fundamental to both keeping global temperature changes below 1.5^{o}C of warming, and adapting to climate risks (IPCC, 2018). Not all behaviour changes involve *passive* nudges. Behavioural interventions can also include information provision, appeals to values and norms, and public engagement, which inherently involve *active* engagement with people (Stern, 2019). The benefits of behaviour changes can accrue over time, especially if they influence high-impact, repeated behaviours (Stern, 2019; van der Linden & Goldberg, 2020). Due to this, behaviour changes cannot be treated in isolation, as they can also have implications for other levels of societal change. Consequentially, O'Brien's (2018) 'three spheres model' highlights that transformational adaptive responses to climate change result from the combination of deliberate changes at *personal* (beliefs, values, worldviews and paradigms), *political* (systems and structures) and *practical* levels (behavioural and technical responses). These inter-level dynamics are also exemplified by the Social Ecological Model, introduced in *Chapter 1* (Bronfenbrenner, 1978). From these perspectives, behaviour changes, along with other socio-cognitive changes, can be viewed as *enabling factor*s within a multi-faceted societal transition toward climate resilience (IPCC, 2018). Individual-level behaviours and attitudes are both influencers *of*, and influenced *by*, broader social and structural changes.

In broad terms, evidence suggests that environmental behaviours can be changed most readily through 'hard interventions', such as policy and structural changes. Good examples of this include the introduction of the plastic bag charge in England, which reduced the number of bags used by shoppers by more than 80% (Defra, 2016), and the development of new cycling infrastructure, which in one study explained around 85% of localised cycling uptake (Prins et al., 2016). Making significant changes to physical, financial or policy environments typically leads to significant changes in related behaviours. However, while changes to infrastructures, policies and financial systems is

essential to mitigate and adapt to climate change, such interventions may be economically or socially costly to roll out, and are unlikely to be accommodated if such measures are at a mismatch with local, or majority public opinion or interests (Clayton, Devine-Wright, Swim, et al., 2015; Devine-Wright, 2012).

In turn, communications can play a key role in engaging the public with the risks of climate change, and fostering adaptation (Corner et al., 2020; Klöckner, 2015; Moser, 2010, 2016; Moser & Dilling, 2007; Whitmarsh et al., 2013). Communications can influence climate adaptation by influencing individuals' engagement at three key levels: the *attitudinal level* (i.e. people's perceptions, opinions and beliefs), the *behavioural level* (i.e. the actions individuals take), and the *affective level* (i.e. people's feelings and emotions) (Lorenzoni et al., 2007; Whitmarsh et al., 2013). There are a range of examples demonstrating the influences of communications on environmental behaviours and attitudes. For instance, Pope Francis' encyclical on climate change led to an increase in the number of Americans stating they were *very sure* that global warming is happening – with 35% of Catholics saying the Pope influenced their attitudes (Maibach et al., 2015). Following the broadcast of the documentary *Blue Planet II,* 88% of UK citizens reported changing their use of plastic, and there was a 100% increase in online searches related to the dangers of plastic in the ocean (Hughes, 2018; Rapid Transition Alliance, 2019). Where behaviour has 'room to move' (i.e. where structural and financial limitations do not restrict behavioural changes), soft interventions, like communications, can play a key role in motivating individual adaptive actions (Klöckner, 2015; Stern, 2019).

Communications can also influence broader social transitions. Communications can change social attitudes, helping to facilitate the accommodation of hard measures (Simms, 2018). For instance, Wordsworth's writings on nature were influential in the establishment of the first National Parks in the U.K. and the U.S.; frameworks of conservation that continue to protect nature and heritage to this day (Bate, 2018). More recently, in the wake of the documentary *Blackfish*, *SeaWorld* experienced a significant drop in investor shares, net income and public attendance, ultimately forcing an end to the attraction's live orca shows (Neate, 2015). And, during this thesis writing, the cumulative influence of extensive civic actions, including protests and demonstrations, have been instrumental in pressuring the UK government to declare a climate emergency, set new Net Zero targets, and establish citizens' assemblies to inform the climate transition. It is difficult to evidence cause and effect here, nevertheless, these examples suggest the important role that soft interventions play in broader societal transformations.

The precursory role of communications has also been shown in other contexts, where there are threats to human health. For instance, years of informational campaigns, public advice and behavioural interventions in relation to the health risks of smoking *(soft interventions)* brought about an accommodating social environment ahead of the nationwide public smoking ban *(a hard intervention),* which dramatically accelerated smoking cessation rates (Diepeveen et al., 2013; Mahoney, 2010; Simms, 2018; Triggle,

2017).[1] Similar changes have been described in relation to cycling infrastructure in the Netherlands, where years of activism (*a form of soft intervention*) about child deaths on roads, led to shifts in social attitudes, then policy and incremental infrastructural changes (*hard interventions*), which, quite literally, paved the way for healthier, less dangerous modes of travel (van der Zee, 2015). Communications can also be used to complement the roll out of innovative policies, and technologies, to help ensure uptake (Rogers, 2003). In such ways, communications can lead to individual level changes in attitudes and behaviour, shifting the window of public policy acceptance (Mackinac Centre, 2019). This can propel power brokers to introduce top-down, hard measures, which may then further accelerate changes in public attitudes and behaviour.

2.2.1 The importance of framing within deep climate engagement

Despite this, not all communications are equal. While responses to communications can be positive, resulting in adaptive behavioural and attitudinal responses, if pitched sub-optimally, communications can also lead to maladaptive responses. These negative responses can include increases in denial, fatalism, avoidance, and maladaptive behaviours (Gifford, 2011; Kahan, 2010b; O'Neill & Nicholson-Cole, 2009). The reasons for this are often complex. Within the field of psychology, over the last several decades, much work has been conducted on behaviour change (see: Michie & Johnston, 2012) attitude change (see: Bohner et al., 2015) and the persuasive effects of communications (see: Dillard & Shen, 2013). While conscious attitudes do influence action (Ajzen, 2011; Ajzen & Fishbein, 1977), various automatic factors can also influence behaviours, attitudes and the success of persuasive communications. Relatedly, a substantial body of research has addressed the key psychological factors that influence environmental and climate relevant behaviours (e.g. APA, 2009; Clayton et al., 2015; Steg et al., 2013). This research tells us that human-environmental attitudes and behaviour are complex, and even when physical and financial conditions are conducive, behaviours will be influenced by a broad range of psychological level factors, such as cognitive biases (APA, 2009; Gifford, 2011), motivated reasoning (Kahan, 2010a; Kahan et al., 2011; Kunda, 1990), social norms (Keizer & Schultz, 2013; Reno et al., 1993) and habits (Klöckner & Verplanken, 2013; Kurz et al., 2015)..

To increase adaptive responses to climate change it is not sufficient to simply increase the *amount* of information that reaches the public - as had previously been suggested by the *Public Information Deficit* model (PID) (Brown, 2009; Kahan, 2010b; Owens & Driffill, 2008; Sturgis & Allum, 2004). Analysis of climate change perceptions from 2002-2010 has indicated that science-based communication has only minimally influenced public engagement (Brechin, 2012; Brulle et al., 2012), while <1% of respondents in a UK survey cited 'scientific evidence' as the reason their climate perceptions had changed

[1] The relationships described here between changes at the individual level, and wider community or policy level make sense when conceptualised in relation to the social ecological model, described in the introductory chapter (Bronfenbrenner, 1978).

(Capstick et al., 2015).[2] Instead, communications that are tailored to audiences and informed by psychology research are expected to be more effective (Bostrom et al., 2013; Corner et al., 2014; Corner & Clarke, 2017c). By understanding the complex psychological factors that influence adaptive responses, and in turn 'framing' communications to harness the power of these underlying factors, communications have a better chance of increasing adaptive responses to climate change.

Given that a range of psychological factors influence adaptive responses, the principle of *framing* is of fundamental importance within the research and practice of climate change communications (Nisbet, 2009). Framing, in its most common conception, is the process of selecting and emphasizing particular aspects of an issue to present information in a certain way, thereby adjusting how that information is interpreted, and (potentially) acted upon (APA, 2020; Schäfer & O'Neill, 2017). As explained by Entman (1993: 52):

> *"…to frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation"*

Framing approaches recognise the PID model is fundamentally limited given the range of barriers and biases that influence individuals' engagement with information about climate change (Nisbet, 2009). Schäfer & O'Neill, (2017) note that different types of framing approaches can be distinguished. A broad contrast can be drawn between *content-oriented* framings which differ in terms of the content of communication, and *formal-stylistic approaches* where the focus is on the structure or presentation of communication, rather than the content (e.g. is the message conveyed through imagery or text? What is the tone of communication?). Content-oriented approaches can be further broken down into *generic frames* and *topical frames.* Generic frames transcend and are abstract from specific issues, such as master frames like 'conflict', 'economic consequences' or ''responsibility', that have been used to communicate a range of issues in European news media (Semetko & Valkenburg, 2000). Topical frames are issue specific (e.g. emphasizing certain climate change impacts, use of specific language, or narratives related to climate change), and are less transferable to other topics. Each of these approaches have relevance to the present research, but particular attention is paid to topical frames (i.e. how the specific issue of climate change is presented), as well as formal framing (i.e. the delivery of climate communication, irrespective of the message).

[2] Respondents within a nationally representative survey who said their views *had* changed were asked why they had become more concerned about climate change in the last 12 months (n=264).

By tailoring content, languages, and narratives, and using certain stylistic framings, communications may influence people's engagement with climate change (Corner & Clarke, 2017b). This often starts with understanding the factors that are particularly influential for behaviour, through social science research, and then designing interventions that resonate with key factors, to harness their influence (as represented in *Figure 2.2.1*). Thus, actively framing climate change can be viewed as a process of deliberately seeking to activate mental processes in the recipient of a message, with the aim of increasing the likelihood of that recipient interpreting or acting upon the message in a specific way.

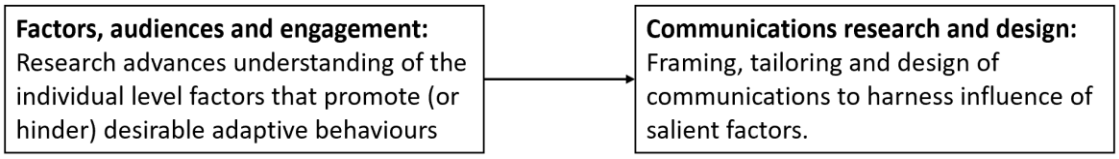


Figure 2.2:1 *- Schematic illustrating the broad two-step process of designing climate change communication interventions.*

Much of the research within climate change communication is now dedicated to understanding which framings are most optimal for engaging the general public, or specific groups, and translating this into communications recommendations (Moser, 2010; Schäfer & O'Neill, 2017)[3] Analysis of framing has involved comparing the effects of environmental, economic and public health framings of climate change (Maibach et al., 2010; Nisbet, 2009), framing climate change to resonate with centre-right values (COIN, 2015; McLoughlin, 2015; Whitmarsh & Corner, 2017) and experimentally manipulating the apparent spatial and temporal distance of climate impact information (Spence & Pidgeon, 2010). Other research has focused on tracking or analyzing framings within media discourses, helping to assess how and why certain frames and representations of climate change have emerged as hegemonic narratives (Antilla, 2005; O'Neill et al., 2015; Schlichting, 2013).

Some study has detected a limited influence of framing on people's engagement (Bernauer & McGrath, 2016), and related commentary has argued that framing altogether 'doesn't work' (Roberts, 2016). However, to discount all framing as *ineffective* is nonsensical – as to frame is an undeniable aspect of communication. As noted by (Nisbet, 2009: 15):

> *"Framing is an unavoidable reality of the communication process, especially as applied to public affairs and policy. There is no such thing as unframed information, and most successful communicators are adept at framing, whether using frames intentionally or intuitively"*

As explored in this review there are myriad ways to frame communications, and a vast range of possible responses. As Corner (2016) retorts, the value of framing comes not through 'one-shot' messages, but through longer term engagement and dialogue. As has been demonstrated, the effects of 'one-off' climate change communications are not guaranteed to persist over time, or lead to action (Howell, 2014; Leiserowitz, 2004). Instead, repeated messages are more likely to be believed and are more likely to influence attitudes (Lewandowsky et al., 2012; Schwarz et al., 2016; Shi & Smith, 2016), and the effects of repeated interventions can be cumulative (van der Linden & Goldberg, 2020). Thus, there is a need to develop a basis for *deep engagement* where narratives are expressed through many communications channels and involve many agents of change. The question of importance concerns which frames are more effective, rather than whether framing itself is right or wrong.

In turn, an emerging body of work concerns the framing of climate adaptation (McEvoy et al., 2013; Moser, 2014, 2016, 2017). Studies have shown, for instance, that framing manipulations can significantly influence perceived severity of climate impacts (Spence & Pidgeon, 2010); can increase flood preparedness behaviours (Kievik & Gutteling, 2011); can influence sceptics beliefs about local climate risks (De Boer et al., 2016); and can influence how adaptively people respond to uncertain climate risks (Morton et al., 2011). In turn, there are a growing number of best practice reports for communicating adaptation (Corner et al., 2020; Corner & Clarke, 2017a; Messling et al., 2015), and notable public engagement projects in the UK, concerning flooding (www.ccri.ac.uk/floodrisk), drought (dryproject.co.uk), and community-level adaptation (www.adaptationscotland.org.uk).

However, while there is growing understanding about framing adaptation, there are still large gaps in the literature, which must be urgently addressed. These gaps relate to (a) the factors that promote adaptation, and (b) how best to optimise communications to address these factors. The next section explores the psychological level factors that promote adaptation (i.e. threat appraisals, coping appraisals and other factors), and notes how communications may influence specific psychological factors. A second section then considers how broader, stylistic approaches to communications (e.g. message style, use of visuals and collaborative engagement) can influence individual level engagement. Finally, a third section considers how to integrate insights about adaptation and communications together. This review illuminates how the concepts of 'threats' and 'coping' play important yet complex roles across the relevant literatures.

2.3 Factors that promote adaptation (and how to harness these factors through communications)

Research about the factors that promote individual level adaptation behaviour has considered behaviours in relation to a range of climate impacts, including flooding (Adger et al., 2012; Soane et al., 2010), wildfires (MacGregor et al., 2007; Martin et al., 2007; Mortreux et al., 2020), drought (Lei et al., 2016), heatwaves (Akompab et al., 2013), and crop yields (Basannagari & Kala, 2013; Leclère et al., 2013). Together such studies have found evidence for a range of socio-psychological factors that influence adaptation at the individual and household level, including risk perceptions, negative affect (i.e. emotions like fear and anger), direct experience of impacts and concern about climate change. Some excellent overviews of such factors have been published (see: Moser, 2014; Taylor et al., 2014; van Valkengoed & Steg, 2019), with Moser (2014) reporting at least 28 factors that can potentially impact adaptation behaviour - highlighting the complex range of influences (See *Table 2.3.1*).

While not all factors can be covered in this review, the following sections are organised thematically, and aim to strike a balance between discussions of the factors that are particularly salient in the research literature, as well as those that are important to introduce ahead of further chapters in this thesis. To help draw out communications implications at relevant moments throughout, each of the subsections about the psychological level factors are structured as: (a) research about the influence of specific factors on adaptation behaviours, followed by (b) how communications and framings have can influence that specific factor.

Table 2.3:1 *- Factors motivating adaptation; from Moser* (2014: 347). The order of factors is not prioritised.

Theme	Factors
Threat Appraisal	• Clear and vivid risk awareness ('feeling at risk'; imagining the affective consequences; can be aided by geographic position, visualization, recent personal hazard experience, understanding of climate change, etc.)
	• Strength of belief in local effects of climate change
	• Degree and understanding of uncertainty, attitudes toward uncertainty (tangibly communicated)
	• Degree of nonadaptive behaviour (e.g., denial, wishful thinking)
	• Existence and belief in safety of existing protections
	• Cultural cognition of risk (motivated reasoning)
	• Trust in scientific information, forecasts, tools
Coping (Response) Appraisal	• Information about possible adaptation options/actions
	• Perceived adaptive capacity
	• Self-efficacy (confidence in one's ability to enact the adaptation, including skills, health, sense of control over decisions, sense of being powerless, helpless, etc.)
	• Group efficacy (regarding collective adaptive action)
	• Response efficacy (confidence in the effectiveness of the adaptation to solve the problem, aided by feedback on effectiveness of past actions)
	• Costs of adaptation actions vs. access to resources

	• Clearly perceived benefits of adaptation option, including nonmonetary, intangible benefits • Perceived fairness • Social acceptability of adaptation options • Social influences (social norms, peers exhibiting adaptive behaviour, etc.) • Community support, social capital • Trust in authorities
Self-Identity	• Orientation toward the common good • Values, beliefs about personal responsibility, family role, professional role, etc. • Attitudes toward change
External Support (Influencing Threat and Response Appraisal)	• Education • Effective risk communication and engagement • Financial and nonfinancial incentives • Meaningful participation in governance/decision-making and deliberative processes • Transparency and accountability in governance • Establishments of beneficial defaults

2.3.1 Threat appraisals

2.3.1.1 Risk perception

Risk perceptions are an individual's subjective beliefs about the likelihood and consequences of a hazard (Breakwell, 2014; Valkengoed & Steg, 2019) and have been strongly related to individual level protective actions (Slovic et al., 1982). Risk perceptions can be distinguished between 'perceived severity' (feeling that the risk will be severe) and 'perceived vulnerability' (feeling personally susceptible to the risk). Research has shown that in the UK, not all those who are at risk of flooding or heat waves are aware of a threat, or feel personally vulnerable (Abrahamson et al., 2009; Burningham et al., 2008; Fielding, 2012) and when unfounded, this 'optimism bias' has been suggested to limit adaptation to climate threats (Gifford, 2011; Marshall, 2014; Taylor et al., 2014).

A large number of studies have explored the relationship between risk perceptions and behaviours related to climate hazards (e.g. Akompab et al., 2013; MacGregor et al., 2007; Martin et al., 2007; Reser & Swim, 2011). Most studies report a significant positive relationship between risk perception and adaptive behaviours, across a range of contexts (Botzen et al., 2013; Brügger et al., 2015; Bubeck et al., 2012; Feng et al., 2017; Grothman & Reusswig, 2006; Reynaud et al., 2013). For instance, Grothman & Reusswig (2006) find that risk perceptions motivate flood protective measures in Germany, and Reynaud *et al.* (2013) find similar results in Vietnam. However, other studies have found weak, non-significant or negative results for this factor (e.g. Horney et al., 2010; Thaker et al., 2016). This highlights that, although risk perceptions are widely measured, the relationship with adaptive action is not straightforward. van Valkengoed and Steg (2019b) explain that these mixed results can be due to methodological differences in operationalizing the measurement of risk perceptions[4] and, because risk perceptions alone are not sufficient to produce adaptive behaviour. This latter explanation is elaborated upon later in this chapter.

In terms of communication, a range of literature has explored the effects of framings on risk perceptions. Often such research has suggested the need to amplify perceived climate risks to generate adaptive responses (Moser, 2010; Pidgeon, 2012; Weingart et al., 2000). In terms of heightening risk perceptions, one prominent suggestion within the literature is that the 'psychological distance' of climate change (i.e. the perceived spatial and temporal distance of impacts) can be reduced by highlighting the ways that individuals and their localities are threatened by the impacts of climate change (Mcdonald et al., 2015; Rowson & Corner, 2015; Schuldt et al., 2018; Spence et al., 2012; Spence & Pidgeon, 2010). Some of this research has attempted to manipulate distance framings to assess causal effects on risk perceptions and actions (e.g. Spence & Pidgeon, 2010). One study found that portraying climate change as proximate resulted

[4] E.g. When risk perceptions measured in the *present* are analysed in relation to *past* rather than *current* or intended *future* protective measures.

in greater personal intentions to adapt, while greater distance was associated with support for broader societal initiatives, such as climate policy (Brügger et al., 2015). However, there are also mixed results around whether proximity promotes adaptive responses (Schuldt et al., 2018), and it has been noted that 'proximising' climate hazards can also exacerbate defensive reactions (Brügger et al., 2015). Furthermore, proximity studies often have not considered relationships between threat and coping appraisals, which may explain mixed results and maladaptive responses.

Overall, a key gap remains around which types of climate hazards (flooding, heat stress, air quality etc.) people feel particularly susceptible to, and why? Although new research (published during the thesis write up) suggests that storms and flooding are perceived to be the greatest risks in the UK, and that concern about heat stress has increased substantially in recent years (Steentjes et al., 2020), other work found that perceptions of air quality impacts were particularly concerning in relation to climate change (Whitmarsh, 2008). Additionally, within the past research, there is limited consideration about what specifically is perceived to be 'threatened', and how this may be related to adaptation. Research in relation to sea level rise has highlighted that, aside from personal health risks, climate hazards can threaten a range of social values (Graham et al., 2013) - such as needs for safety, belonging, and self-esteem. However, such threats have little been related directly to adaptive behaviour. Considering these issues further is important to understanding how perceptions of risk relate to adaptive responses, and how to better communicate risks.

2.3.1.2 Direct experience

A range of research has addressed how direct experience of hazards can alter risk perceptions, engagement with climate change, and behaviours. Some of these studies have qualitatively addressed the impact of related hazards, like flooding, on communities and livelihoods (Aerts et al., 2018; Bell & Tobin, 2007; Fillmore et al., 2011; Graham et al., 2013; Walker-Springett et al., 2017). Other research has addressed how experience of hazards can influence perceptions of climate change, though these findings are mixed. Research has found that residents who live in flood affected areas have higher concern about, and reduced psychological distancing, of climate change (Capstick, Demski, et al., 2015; Demski et al., 2017). However, other research has suggested that experience of extreme weather events does not necessarily increase perceived risks of climate change (Dessai & Sims, 2010; Whitmarsh, 2008).

The role of direct experience of a climate hazard has also been frequently studied in relation to adaptation behaviour, though again, studies have mixed results. Some research shows a positive relationship between experience and protective action (e.g. Działek et al., 2016; Elrick-Barr et al., 2016). Experience of flooding, for instance, has been found to reduce uncertainty about the risks of climate change, strengthen beliefs that individual actions will make a difference, and increase willingness to perform mitigation behaviours by reducing energy consumption (Spence et al., 2011). One study suggests that direct experience of one event (such as flooding) may have a spillover

effect, increasing willingness to adapt to another hazard (Demski et al., 2017). However, other work does not suggest experience leads to protective actions (Chaney et al., 2011; Hall & Slothower, 2009). Some research highlights that experiences of risks can increase maladaptive responses, by catalysing a sense of fatalism (Ejeta et al., 2015).

The mixed results may be influenced by dispositional and contextual factors. Some studies suggest that *subjective attribution* of extreme weather to climate change increases perceived threat, and willingness to mitigate climate change - and this effect be mediated by political worldview (Ogunbode et al., 2017, 2018). There can also be geographical variations in flood victim's responses, suggesting social and contextual factors are important. Flood victims in Cumbria, UK, for instance, reported feeling a greater personal responsibility to act on flooding than flood victims in Galway, Rep. of. Ireland (Adger et al., 2012).

In terms of communication approaches, the charity Climate Outreach cautions that public engagement with flood victims must be carried out sensitively, or it will backfire (Messling et al., 2015). The authors note the importance of recognising the *needs* of vulnerable communities and engaging sensitively. Other work has suggested that technical presentations of flood risk information (e.g. "once in a lifetime" or "1 in 100 years") are unhelpful, and may not be interpreted correctly by those at risk (Bell & Tobin, 2007; Cologna et al., 2017). Together this suggests that finding the right language and framings is important to facilitating adaptive, and avoiding maladaptive climate responses, in vulnerable contexts.

Overall, there is currently little research about how individuals who are particularly vulnerable to climate impacts have experienced communications interventions from authorities and organizations; and how such engagement may shape willingness to respond to climate impacts. Furthermore, aside from one notable study (Medd et al., 2015) there is relatively little known about how people's experiences and actions may alter across time, for instance, before, during and shortly after climate hazards. This information would be useful to help clarify the needs of individuals during and following such events and could inform better engagement.

2.3.1.3 Negative affect

It has long been known that threats and sources of stress relate to negative affect. Threatening situations can increase emotions such as anger, fear, worry and anxiety. Negative affect is thought to promote behavioural response to threats, as individuals may attempt to alleviate discomfort brought about by experiencing such emotions (Lazarus, 2006; Lazarus & Folkman, 1984). Emotions can be powerful influences on risk perceptions (processed via an 'experiential' system) sometimes having a greater influence than factual information (processed via an 'analytic' system) (Slovic et al., 2004). Given this, negative affect can also inhibit adaptive responses and promote maladaptive responses in varied circumstances. For instance, anxiety and phobias may prevent individuals from engaging in beneficial personal behaviours (Bourne, 2011);

while in moments of crises, ‘fear contagion’ can promote problematic responses amongst society, such as stockpiling of foods and other household goods (Barsade, 2002; Hatfield et al., 1994; Kramer et al., 2014; Taylor, 2020). Thus, it is important to acknowledge the role of emotion for risk processing and behaviour.

Negative affect has been well researched in relation to extreme weather and climate change communication. Research has highlighted how experience of extreme weather events can promote negative emotional outcomes (e.g. Griffin et al., 2008; Messling et al., 2015). Other research has highlighted the potential for longer negative outcomes for mental health such as anxiety and depression (Foudi et al., 2017; Waite et al., 2017; Walker-Springett et al., 2017). Together, this work suggests that management by authorities, communities’ responses, and the support networks available to individuals in the aftermath of events, can influence the extent of negative emotional and mental health outcomes.

However, there are mixed results about the influence of negative affect on climate adaptation. In some studies, negative affect has been shown to promote adaptive behaviours, such as preparing for floods (e.g. Kerstholt et al., 2017). Other work suggests this may be true within the general public, as well as within vulnerable communities. Rather than being problematic, one study finds that habitual ecological worrying is associated with adaptive responses to climate change (Verplanken & Roy, 2013). However, other work has not found a strong link with adaptive outcomes related to climate hazards (e.g. McFarlane et al., 2011).

In terms of climate change communications interventions, researchers have cautioned against over-stimulating negative emotions, such as fear (O’Neill & Nicholson-Cole, 2009). This research suggests that while fear appeals can capture attention, they typically lead to defensive, negative reactions, and can increase maladaptive responses such as denial, anger and discounting of risks. Other researchers have suggested that fear appeals should not be avoided completely, as these can be effective for certain groups (see commentary by Leiserowitz in Zhang, 2019). Broadly speaking, a middle ground approach suggests that fear arousing interventions can be effective in promoting adaptive responses if specific behavioural recommendations are also made alongside, and if a balance is struck between heightened threat appraisal and other motivational cognitions, such as ‘self-efficacy’ (Maddux & Rogers, 1983; O’Neill & Nicholson-Cole, 2009; Peters et al., 2013; SWOV, 2015; Witte & Allen, 2000).

Nevertheless, despite this existing literature, research is still needed to disentangle the relative influence of negative affect for adaptation, compared to other factors discussed. Furthermore, novel research may aim to better understand the ways in which negative affect may manifest amongst vulnerable communities, in relation to public engagement and management of climate hazards.

2.3.1.4 Perceptions of climate change

Perceptions of climate change are perhaps the most widely studied individual level factors related to climate change engagement. Over recent years, a broad range of social research has sought to understand and track climate perceptions, and analyse associations with climate behaviours (e.g. Arnold et al., 2016; Capstick et al., 2015; Kahan et al., 2012, 2011; Leiserowitz et al., 2013, 2016; Maibach et al., 2009; Moser, 2010). Studies often have measured concern about climate change, or beliefs about the causation of climate change. Concern about climate change is a form of negative affect resulting from a risk perception, and therefore is considered to influence behaviour when individuals seek to minimise the threat posed by climate change. Concern about climate change has been positively associated with mitigation-focused actions in a range of contexts (Doherty & Webler, 2016; Spence et al., 2011; Verplanken & Roy, 2013). However, it has not been studied as frequently as an explanatory variable that influences adaptation behaviours. Brügger et al., (2015) find that individuals who believe climate change is a real and dangerous risk are more willing to respond to climate change through mitigation and adaptation behaviours. However, other work has found climate perceptions only minimally motivate behaviour, such as purchasing flood insurance (Shao et al., 2017). Given this, it is unclear as to how well climate perceptions predict adaptation, and this should be addressed further.

Research has shown that climate change perceptions are often influenced by political events and media coverage – highlighting the influential role of communications here (Brechin, 2012; Brulle et al., 2012). Concern can also be shaped by knowledge or experience of extreme weather (Capstick, Demski, et al., 2015; Demski et al., 2017). In one study, the most common reason given for increased concern about climate change was floods, heavy rain, and rising river levels (Capstick, Demski, et al., 2015). However, research also suggests that concern about climate change can be outcompeted by other salient concerns, as individuals may have a 'finite pool of worry' (Capstick, Whitmarsh, et al., 2015; Moser & Dilling, 2011; Weber, 2010; Whitmarsh, 2011). Nevertheless, there is also clear evidence that individuals tend to feel more concerned about climate change when something highly valued is perceived to be threatened, and this can vary with political worldviews (see section below about values).

There is a vast range of research dedicated to understanding the most optimal ways to frame communications to alter climate perceptions (Clayton, Devine-Wright, Stern, et al., 2015; Moser, 2010; Whitmarsh et al., 2013; Whitmarsh & O'Neill, 2010). Such research has addressed a range of factors (many of which are considered in this review) and attempted to understand how framings can be altered and tailored to specific audiences. However, relatively little research offers specific guidance related to adaptation, or communicating climate change in the most vulnerable communities (Moser, 2014, 2016). Of the communications guidance that does exist, it has been advised that attempts to make links between flooding and climate change should be carried out with care, as this can be insensitive to those directly affected, especially during a flood event (Messling et al., 2015). Within the general public, the challenge may

be less about increasing concern, and more about increasing a sense of personal relevance (Mcdonald et al., 2015). However, as noted earlier, research has not yet provided adequate guidance on how best to proximise climate change, increasing a sense of personal relevance, without promoting maladaptive responses (Brügger, Dessai, et al., 2015). Further research is certainly required to address these gaps – and to establish whether climate perceptions play a role in promoting adaptation.

2.3.2 Coping appraisals

2.3.2.1 Efficacy

For individuals to engage in adaptive actions, much research points towards the need for there to be a sufficient sense of 'efficacy'. Efficacy is often distinguished between two main types. 'Self-efficacy' concerns the extent to which individuals feel *personally able* to carry out specific tasks (Bandura, 1977), whereas 'response efficacy' (sometimes referred to as 'outcome efficacy') concerns how *effective* actions are perceived to be in bringing about desired outcomes (Maddux & Rogers, 1983; Rogers, 1975). Much research has highlighted how high levels of efficacy are associated with adaptive responses relative to health threats, such as smoking, healthy eating, and avoiding risky sexual behaviour (Floyd et al., 2000; Witte & Allen, 2000). Efficacy is therefore considered to be an important antecedent to actions aimed at resolving threats. Though highly related, efficacy can be distinguished from 'agency' (meaning, the capacity of individuals to act independently and make free choices). It has also been suggested that agency refers to *actual* capability, while efficacy is *perceived* capability, and thus, efficacy can be described as an 'agentic function' (Bandura, 2017).

In turn, efficacy has been studied in relation to a range of climate adaptation behaviours. Many studies find a positive association between hazard preparedness and efficacy (Botzen et al., 2019; Bubeck et al., 2013; Grothman & Reusswig, 2006; Grothmann & Patt, 2005). For instance, one study showed that flood adaptation behaviour in flood prone households in the Rhine, Germany was strongly influenced by self and response efficacy (Bubeck et al., 2013). It has been shown more broadly that efficacy is important for climate mitigation behaviours as well. Truelove & Parks (2012) found that belief in behavioural effectiveness was crucial for influencing whether energy conservation actions are carried out (irrespective of effectiveness in real terms). Furthermore, Doherty & Webler (2016) found that self-efficacy, response efficacy and collective efficacy (i.e. perceiving that outcomes can be achieved together, through group action) were key factors associated with greater intentions to engage in civic behaviours relating to climate change, amongst the most alarmed segment of the U.S. population.

However, despite its important role, efficacy beliefs amongst the public can be limited, and can be undermined. One study found that in the aftermath of the 2013/14 Somerset floods, a lack of 'agency' and sense of powerlessness were associated with negative wellbeing outcomes, such as stress and anxiety (Walker-Springett et al., 2017). Furthermore, Poortinga et al. (2018) report that across Europe, self-efficacy is limited in

relation to climate mitigation actions, like household energy behaviour. In sum, this work suggests that interventions are required to nurture climate-related efficacy to promote action, and to foster positive coping in the wake of a hazard, or extreme weather events.

Efficacy can be influenced in several ways. Bandura, (1994) explains that efficacy can be enhanced most substantially through *mastery* – personally experiencing successes – while efficacy may be undermined through failures (especially if they occur before efficacy is firmly established). Efficacy can also be increased by *vicarious learning* - seeing others overcome challenges - and through *social persuasion* - whereby an individual is convinced of their personal capabilities by others. Fittingly, self-efficacy related to protective flood actions has been associated with participation in flood action groups (Dittrich et al., 2016), as well as observational learning from the social environment, and competence in technical and social skills (Bubeck et al., 2018; Seebauer & Babcicky, 2020). However, people's sense of agency can also be impacted negatively not just by hazards, but by the responses of authorities (Walker-Springett et al., 2017).

In terms of communicating efficacy to promote climate adaptation, a study carried out in the Netherlands manipulated messages to heighten a sense of risk and/or efficacy (Kievik & Gutteling, 2011). This work found that participants in the high-risk, high-efficacy message group were more likely to report behavioural intentions and carry out information seeking, related to flood preparedness. This work fits with a meta-analysis of health communications studies, which found that interventions that increase efficacy tend to be more effective than those which only heighten a sense of threat (Witte & Allen, 2000). In turn, researchers have highlighted a need to foster a sense of empowerment when engaging with people at risk of climate impacts (Messling et al., 2015). Broadly speaking it seems that communications interventions related to climate hazards should aim to foster a sense of efficacy, to promote adaptation to climate change.

However, despite consistent results showing that efficacy is an important antecedent for adaptive behaviours, several research gaps remain. For instance, while Walker-Springett et al., (2017) note that institutional responses can implicate agency in response to floods, further research could helpfully address how 'top down' engagement can have implications for adaptation actions, in addition to wellbeing outcomes. Additionally, there has been little research into the relationships between adaptation, collective efficacy, and political efficacy (i.e. feeling well informed about, and able to participate in, political decision making – see Feldman & Hart, 2016). There is also a lack of understanding about whether certain forms of efficacy are influential for certain types of responses and not others (as noted by Bubeck, Botzen, & Aerts, 2012). For instance, it may be possible that self-efficacy, collective efficacy and response efficacy act as mechanisms for different types of actions, such as personal versus collective actions. Furthermore, research should be dedicated to unpicking the process of building efficacy through communications. Do certain types of efficacy messages work more effectively than others? What are the challenges of translating research into practice, or attempting to

nurture efficacy, and, like fear appeals, can this also backfire? More research is certainly needed to address these gaps.

2.3.2.2 Perceived costs

The perceived costs of actions are also an important influence on their uptake and accommodation. Simply put, if an action is presumed to have a negative impact to oneself personally, then individuals are less likely to carry out this action (Maddux & Rogers, 1983; Rogers, 1975). When making life decisions, individuals tend to avoid losses rather than seek gains (Kahneman et al., 1982). In turn, perceived costs have been shown to reduce willingness to engage with coping responses related to climate change and flood preparedness (Bichard & Kazmierczak, 2012). However, one paper found that other factors, such as perceived risk and ability to carry out preparedness actions, were better at explaining adaptive responses (Thieken et al., 2007). Key questions remain around the factors that shape the perceived undesirability of certain coping responses, and the viability of loss and costs framings in relation to communicating adaptation.

2.3.3 Other factors

2.3.3.1 Social norms

Social norms concern the actions and beliefs that are common and approved within social groups or wider society (Cialdini & Trost, 1998; Sherif, 1936). Social norms can be distinguished between two key types: *descriptive norms* are the observable common behaviours of other people, while *injunctive norms* are other people's beliefs about what 'ought to be', and therefore, what is seen to be permissible within a social group (Keizer & Schultz, 2013). Social norms exert an influence on behaviours via conformity bias, in which a person feels motivated to align with majority practices. When an individual perceives that their actions are not aligned with the observable or perceived actions of the majority, a cognitive dissonance compels the individual to align their actions with the majority (Cialdini & Trost, 1998; Reno et al., 1993). Through this effect, social norms have been shown to influence a range of environmental behaviours, such as energy consumption, recycling, towel reuse, and climate activism (Doherty & Webler, 2016; Goldstein et al., 2007; Keizer & Schultz, 2013; Nolan et al., 2008; Stern et al., 1999; Thomas & Sharp, 2013). Related to adaptation, descriptive norms can encourage purchasing of flood insurance (Lo, 2013), and uptake of drought-resilient farming practices (Truelove et al., 2015). However, social norms may also inhibit adaptation, and promote maladaptation. For instance, cultural injunctive norms associated with the caste system in India and Nepal have prevented vulnerable members of society from accessing protection, such as shelters, during floods (Jones, 2010). Social norms are therefore likely to be an influential aspect of adaptation, with specific contextual manifestations.

Communications can harness the influence of descriptive social norms by communicating where there are positive actions being taken by the majority (Goldstein

et al., 2007; Griskevicius & Cialdini, 2008; Nolan et al., 2008). For instance, an influential study found that leaflets highlighting positive norms were more effective at influencing household energy behaviour that environmental protection, self-interest or social responsibility framings (Nolan et al., 2008). However, as Corner (2011) highlights, social norms interventions may not be possible when the majority behaviour is undesirable, and therefore, interventions must be designed carefully. How 'maladaptive majorities' can be engaged with is therefore an important line of research that needs addressing further.

2.3.3.2 Values

Within the last few decades, 'values' have become an increasingly important focus of social research about climate change (Corner et al., 2014). Values can be defined as abstract, life guiding principles, or trans-situational goals, relating to one's conduct and the way society is organised (Schwartz, 1992, 2012). Examples of values include *benevolence*, *security*, *power* and *achievement*. Unlike attitudes, behaviours and emotions; values transcend specific situations, and are typically more stable across time, forming the 'bedrock' of a person's identity (Corner et al., 2014). Values are therefore highly related to worldviews and ideology (Lewandowsky et al., 2013; Xue et al., 2014).

Values have been shown across many studies to influence perceptions of climate change, support for climate policy, personal climate actions and other pro-environmental behaviours (Corner et al., 2014; De Groot & Thørgerson, 2013; Honkanen et al., 2006; Kahan et al., 2011; Thøgersen & Ölander, 2002; Verplanken & Holland, 2002). Research shows that individuals who place greater value on self-transcendent goals related to social equality and nature (i.e. 'universalist' and 'biospheric' values), are typically more alarmed about climate change and supportive of action (Corner et al., 2014; De Groot & Thørgerson, 2013; Evans et al., 2012; Kahan et al., 2011; Ogunbode et al., 2017; Stern et al., 1995). For such people, climate change tends to be perceived as a significant threat to nature and society. Conversely, values also influence climate scepticism and denial (Kahan, 2010b; Kahan et al., 2011). Research has consistently found that individuals with right wing, *self-interested* or *egoistic* values tend to be less concerned about climate change, typically perceiving climate action as a *threat* towards free market economics (Corner et al., 2014; Kahan, 2010b). Values thus appear to influence whether an individual perceives the most alarming source of threat to be climate change itself, or the broad coping strategies required to combat climate change. Interestingly, values effects occur irrespective of knowledge and understanding of climate science, and polarisation appears to increase with greater science literacy and numeracy skills (Kahan et al., 2012).

While values are influential in relation to limiting climate change, their relationship with climate adaptation is under researched. Broad social values are considered to be important for adaptation in the sense that they may shape the priorities and limits of societal and community level adaptation (Adger et al., 2009; IPCC, 2014; O'Brien, 2009). However, very little research has addressed whether personal values *directly* influence

adaptation actions - such as protection of one's home from flooding. Some work suggests there is a positive role. One study finds that the attribution of flooding to climate change and willingness to take mitigation actions is mediated by political affiliation (Ogunbode et al., 2017). This work suggests that values (at least in their manifestation as political preference) shape the perceived connection between climate change and flooding. Those on the right-wing were less likely to attribute an extreme event to climate change, and less willing to mitigate climate change. While this study only concerned mitigation relevant behaviours, other research suggests that mitigation is more engaging for people who have high concern about climate change, whereas adaptation is engaging for lower concern groups (Howell et al., 2016). In turn, researchers have also argued that, unlike mitigation, adaptation issues like flooding and sea level rise are not politically polarising - given responding to such hazards at a local level would be socially normative and necessary, irrespective of one's values (Kahan, 2013). This seems founded, as support for adaptation of climate change can be seen across the political spectrum, with prominent climate sceptics publicly advocating for adaptation (CFR, 2012). Other research has detailed how social values - such as a sense of belonging, or community - can be threatened by climate hazards, like sea level rise (Graham et al., 2013). This work shows that irrespective of the role values play in adaptation, climate hazards themselves can directly threaten values.

Communications can harness the influence of values, by framing language to be value congruent (Corner et al., 2014; Corner & Clarke, 2017b; De Groot & Thørgerson, 2013; Demski et al., 2013). Given the stability of values, the purpose of values-based communication is not to attempt to change values, but rather resonate with them (Corner et al., 2014; Corner & Clarke, 2017b; Kahan, 2010). Values interventions to date have explored messages that resonate with specific value groups, commonly those who are sceptical of climate change (COIN, 2015; Kahan, 2010; Marshall et al., 2016; McLoughlin, 2015). For instance, framing energy efficiency as a "waste" issue has been found to be engaging for conservative groups, without turning off environmentalist groups (Whitmarsh & Corner, 2017). Some communications guidance suggests that values-based engagement is applicable to adaptation (Corner & Clarke, 2017a). However, given that the role of values in adaptation is not clear, this approach may be insufficient, unless found to be validated by further research. In turn, certain non-values based framings of climate change may cut through values - for instance, framing climate change as a *health threat* appears to be effective across the political spectrum (Kotcher et al., 2018; Myers et al., 2012). This may simply be because individuals tend to value personal health, irrespective of their socially oriented values.

2.3.3.3 Place attachment

The extent to which people feel a bond with place is another factor that has been researched in relation to adaptation (Moser, 2014). Local people's place attachments can act as a barrier to the accommodation of new energy infrastructures, like power lines, as individuals seek to preserve their local contexts (Devine-Wright, 2012). Similarly, place attachments have been shown to increase resistance to flood defenses, when individuals perceive the transformative adaptation to disrupt a valued place (Clarke

et al., 2018). This research suggests that strong place attachments can lead to resistance to adapt. However, attachment to place and local society also appears to be an important part of adaptive coping. Research shows that communities bond in the aftermath of flood events, as people offer social support to one another (Butler et al., 2016; Walker-Springett et al., 2017). Not only may place attachment facilitate coping in such cases, but bonds may be increased as well.

Other research suggests there is no evidence that direct flood experience or perceived risks influence the strength of place attachments (Clarke et al., 2018). However, as noted in the section above, climate change may threaten social values related to place, community and belonging (Graham et al., 2013). This discrepancy warrants further research, as its feasible that place attachment can be both disrupted or increased in relation to climate hazards. Furthermore, in some cases, climate hazards may pose dilemmas for individuals who simultaneously have strong place attachments, yet recognise certain adaptation behaviours, like evacuating or migrating, are necessary. This also would be interesting to research further.

To date, communications research has little addressed place attachment in relation to adaptation. Given local knowledges are considered to be crucial to adaptation efforts (IPCC, 2014), and are increasingly being incorporated into catchment-level flood management practices in the UK (Defra, 2013), this is certainly an area requiring further input.

2.3.3.4 Trust

The extent to which individuals trust authorities is another important factor that has been addressed in relation to adaptation (Moser, 2014). Public trust can influence how willing individuals are to take adaptation actions (Koerth et al., 2013), and also whether they support planned adaptation measures (Hagen et al., 2016). However, the influence of trust appears to be mixed. For instance, some research suggests that individuals who took flood protective actions did not trust the government to carry out necessary actions to protect their household (Elrick-Barr et al., 2016).

The use of well-known and trusted communicators has often been recommended in terms of communicating climate change. Individuals who are perceived to be a member of one's own 'in-group' are typically favoured (Diehl, 1990; Hertel & Kerr, 2001; Tajfel, 1978, 1996), and may influence the actions of their group more effectively. For instance, there is evidence that Pope Francis has substantially influenced climate attitudes amongst U.S. Catholics (as noted earlier; see: Maibach et al., 2015), and that speeches by Margaret Thatcher can help to engage centre-right groups with climate change (COIN, 2015; McLoughlin, 2015). These effects tie in with evidence that members of outgroups are more likely to be viewed as posing an intergroup threat (Stephan & Stephan, 2000). Despite this literature, research addressing the role of trusted in-group members has been limited in relation to communicating climate adaptation.

2.4 How communication factors can influence individual level adaptive responses

The previous section addressed several socio-cognitive factors that influence peoples' climate adaptation behaviours. As noted throughout, communications can be framed to harness the influence of these factors. However, there are also other 'communication level factors' which are important to address too. The following section considers some of the key factors relating to the design and framing of communications, which can be shaped by communications practitioners. While this literature has little been linked to climate adaptation directly, the principles are likely to be important when administering messages about adaptation behaviours. While not all communication factors can be covered, those of focus have been shown to play important roles in determining the efficacy of communications and are relevant to subsequent chapters.

2.4.1 Threatening versus non-threatening communication

Whether communications are administered in a seemingly threatening or non-threatening manner may determine whether individual responses to behavioural requests are adaptive. Communications may be perceived to be threatening for a range of reasons - for instance, if they are highly critical, disruptive, focus on loss, or restrict a sense of freedom. For instance, governments may introduce measures that are perceived to be highly restrictive and burdensome, resulting in resistance, and protest,[5] while social movements may unintentionally alienate members of civil society from their cause, by using disruption aimed at building public support for action.[6] Analysis shows that environmental campaigning often utilises assertive messages (see: Kronrod et al., 2012). Examples of this include the Ad Council's "Only YOU can prevent forest fires", Greenpeace's "Stop the catastrophe", and the 10:10 campaigns' ironically titled short film, *No Pressure.*[7]

Related to this is a consistent base of research which shows that if requests are carried out in ways that diminish individuals' sense of freedom to go about their life and make choices in whatever way they wish, then such attempts at persuasion are more likely to be rejected (Dillard & Shen, 2005). Freedom threatening messages stating '"you must"

[5] A good example of this is the Mouvement des Gilets Jaune, which saw mass protests in parts of France. Although a range of issues gave rise to the protests, one of the key factors was the introduction of greater fuel taxation aimed at reducing fossil fuel use, which was perceived as burdening the poor and working classes. Given some evidence suggests the Gilets Jaune movement is supportive of climate change action (Atkin, 2018), a significant catalyst for the action appeared to be the threatening, non-consensual way in which the policy was introduced (Rubin & Sengupta, 2018).

[6] A YouGov Poll carried out in October 2019 found that a majority (54%) opposed or strongly opposed climate change protesters "disrupting roads and public transport, aiming to "shut down London" in order to bring attention to their cause" (YouGov, 2019: npn)

[7] No Pressure showed people in every-day situations being graphically blown to pieces for failing to be enthusiastic about reducing CO2 emissions. The film was quickly withdrawn due to its negative public reception. See: https://en.wikipedia.org/wiki/No_Pressure_(film)

rather than “you have a free choice” are therefore likely to be less favourable. Psychological Reactance Theory (PRT) (Brehm, 1966, 2000) posits that experience of such ‘freedom threats’ can increase anger, and cause individuals to increase behaviour that is counter to behavioural requests, as they seek to re-establish a sense of autonomy. This effect has been shown in relation to sustainable transport - where study participants reacted negatively to restrictive messages concerning transport choices (Murtagh et al., 2012). Another study found that messages about the scientific consensus on climate change increased people’s level of reactance, especially among those who denied climate change is happening (Ma et al., 2019). Such an effect may be more pronounced when individuals have a higher trait reactance (i.e. valuing freedom above other needs), a trait which has been associated with liberterian values (Dillard & Shen, 2005; Hong & Faedda, 1996; Iyer et al., 2012). This perhaps sheds further light on why such value groups are more likely to deny or discount the need to combat climate change - as measures are likely to be perceived as threatening freedoms, from the economic to the personal level (Carrington, 2017; Kahan et al., 2011).[8] Reactance may also be associated with a tendency not to conform to social norms (Goldsmith & Clark, 2005).

Other variables apart from a need for freedom can be threatened too. For instance, Identity Process Theory (IPT) (Breakwell, 1986; Jaspal & Breakwell, 2014) posits that individuals can experience an ‘identity threat’, when the processes that help maintain their sense of self-identity are disrupted. The processes include needs for belonging, distinctiveness, self-efficacy, continuity and self-esteem. While a range of circumstances may induce a sense of threats to such needs, behavioural interventions can be a significant source of threat, potentially forcing individuals to use a range of adaptive and maladaptive coping strategies to alleviate any suffering induced. Coping may range from interpersonal support through to denial, fantasy, and escapism. It has therefore been argued that framing climate change communications to foster, rather than threaten, individual needs for efficacy, self-esteem (and so on) may help to prevent negative reactions to such engagement (Jaspal et al., 2013). There are clear overlaps here with aforementioned research about the need for communications to foster a sense of efficacy to climate threats (Messling et al., 2015) and how a lack of agency in the aftermath of flooding can lead to negative wellbeing outcomes (Walker-Springett et al., 2017).

However, contrary to these perspectives, other work has shown that seemingly threatening messages can increase adaptive responses. Criticism and admonishment, for instance, have been shown to be an effective means of persuasion in a range of literature. Swim & Bloodhart (2013) found that criticism of environmentally damaging behaviour (using an elevator rather than the stairs) promoted a greater willingness to

[8] Myron Ebell, a prominent climate sceptic and former Trump administration advisor who was pivotal in the U.S. withdrawal from the Paris Accord, has described the green movement as “the greatest threat to freedom and prosperity in the modern world” (Carrington, 2017).

engage in environmental behaviour. Other research has found that assertive messages promote better engagement with environmental charities when the audience already perceive environmental issues to be important (Kronrod et al., 2012). Classic psychology literature has also shown that individuals will comply with requests they do not necessarily agree with, if assertive requests come from authority figures (Burger, 2009; Cialdini & Trost, 1998; Garbett & Milgram, 1975).

To explain this, Social Impact Theory (SIT - Latané, 1981, 1996; Latané & Wolf, 1981) suggests that a 'multiplication of impact' can cause individuals to change their actions. This theory posits that the more people demanding an individual or group to change practices, the more likely the change is to occur. This helps to explain how polemic groups can force decision makers to bow to public pressure (Moscovici, 1974, 1988), and how social tipping points can accelerate behavioural changes in society (Centola et al., 2018; Otto et al., 2020). Breakwell (1986) has also suggested that to bring about fundamental change in an individual's identity and practices, an individual must experience a sustained threat to their personality, behaviours, practices and beliefs, leaving them with no options left but to change, to alleviate the cognitive dissonance experienced.

Despite this, research has also pointed out that a 'divisional effect' can buffer individuals from a sense of threat posed by persuasive communications. Again, this research stems from SIT, which also suggests that an individual's attempt to persuade is likely to diminish the greater the size of the group or audience being engaged (Latané, 1996). One study found that evangelical preachers were less able to encourage new members to sign up when speaking to larger, rather than smaller audiences (Latané, 1981), while another study showed that zookeepers were less able to persuade larger groups not to lean on railings of enclosures (Sedikides & Jackson, 1990). This line of research is likely to be important in communicating adaptation, as it suggests it may be difficult to challenge widespread or majority, maladaptive practices. Overall, further research is certainly needed to address these threat dynamics in relation to climate adaptation, given the existing literature leaves a dilemma for communicators about whether '*to threaten, or not to threaten*?'

2.4.2 Text and imagery

The medium of communication is also an important factor to consider for conveying climate information. Communications about climate change may be mediated through a range of mediums, including face to face conversations, news media reports and via computer interfaces (Klöckner, 2015). Often, written and verbal communications are used to convey information about climate change, but in media, campaigns and popular discourses, imagery is also often used (O'Neill, 2013; Wang et al., 2018). Research has suggested that textual information may be processed by analytic cognitive processes, while imagery may be processed more intuitively, emotionally and experientially (Adaval et al., 2018; Epstein, 1994; Leiserowitz, 2007). Imagery, unlike text, typically is efficacious at drawing the attention of audiences, and can generate stronger affective,

physiological and behavioural responses (Childers & Houston, 1984; Noar et al., 2016). Images can also improve retention and understanding of information (Brady et al., 2008) and influence mental pictures (Adaval et al., 2018). This latter point is important, as the ability to 'simulate' phenomena can influence decision making, and appraisals of events (Kahneman et al., 1982). In turn, imagery can play a significant role in determining adaptive responses to communication about climate change, and although more research is dedicated to textual analysis, a range of research on climate imagery has emerged in recent years (Corner et al., 2015; Hart & Feldman, 2016; Leiserowitz & Smith, 2017; Metag et al., 2016; O'Neill, 2013; O'Neill et al., 2013; O'Neill & Smith, 2014; Svensson & Olausson, 2014; Wozniak et al., 2015).

The existing research base suggests that images can affect both threat and coping appraisals related to climate change. For instance, O'Neill & Nicholson-Cole, (2009) found that strong impact imagery (e.g. depictions of flooded houses) can increase people's attention and the perceived importance of climate change. Research has found that images of impacts tend to increase a sense of issue importance, though they may also have a "boomerang effect" in which they diminish a sense of self-efficacy (Byrne & Hart, 2009; Hart & Nisbet, 2011; O'Neill & Nicholson-Cole, 2009). While dramatic and potentially fear-inducing images of climate impacts and extreme weather may increase issue 'salience' they can lead to maladaptive responses, leaving individuals feeling overwhelmed rather than motivated to respond to the threat of climate change (O'Neill, 2013; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). Instead, images of actions and solutions related to climate change have been shown to increase a sense of self-efficacy (Metag et al., 2016; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). For instance, Chapman et al. (2016) find that images of solutions produced positive affective responses and less polarization; while experimental analysis by Hart & Feldman (2016) demonstrated that solution-focused imagery (e.g. depicting solar panels) and texts about actions to address climate change increase individuals' perceived efficacy. However, this latter study did not find evidence that exposure to images of either climate impacts or climate pollution had a negative influence on perceived efficacy, or a positive influence on perceived issue importance. Further research may therefore be required to unpick how impacts and solutions can influence both threat and coping appraisals and make links to adaptation rather than mitigation behaviours. It would also be of use to understand how certain impact framings may elicit varied responses in risk perceptions and issue salience.

Other research findings highlight the importance of framing climate imagery in terms of human impacts and stories. Mixed methods research in three European countries demonstrated the need to depict emotionally resonant human stories, through authentic (rather than staged) climate imagery (Chapman et al., 2016). This finding, along with others mentioned above informed the key principles of the Climate Visuals project (climatevisuals.org) to 'show real people' and 'show emotionally powerful impacts' (Corner et al., 2015). This work suggests that common environmental symbols of climate change imagery, such as polar bears, induce greater psychological distance; while

humanizing climate change helps to proximise the threat. These principles also fit with findings that health communications can be particularly effective when imagery shows negative outcomes for people, in combination with efficacy messages (Byrne et al., 2019; Noar et al., 2016; Thrasher et al., 2011; Wakefield et al., 2008). These principles also overlap with the "identifiable victim effect" where people tend to be more readily persuaded to respond charitably when a specific, identifiable person is observed in negative circumstances, compared to a large vaguely defined group (Kogut & Ritov, 2005).[9] It therefore seems that showing real people may help to bring climate change home - though to date, no research has experimentally tested this assumption - to confirm whether the inclusion of people in imagery influences threat or coping appraisals, or behavioural intentions. This is therefore an important research gap, which should be addressed.

2.4.3 Co-production

The IPCC highlight the importance of working with local knowledges to inform adaptation (IPCC, 2014). In recent decades, interest around participatory engagement and deliberative democracy has grown substantially within the social sciences and policy making (Brandsen et al., 2018; Jasanoff, 2004; Miller & Wyborn, 2018). Co-production, a form of participatory engagement, aims to incorporate diverse actors into decision making and implementation processes (Howarth, 2019). At the heart of co-production is an aim to *enable the democratization of politics* (Jasanoff, 2010) by giving end users who are likely to be implicated by decisions a greater stake in how policies, activities, products (and so on) are designed and implemented (Howarth, 2019; Voorberg et al., 2014). Co-production therefore *"enables closer collaboration between a range of actors, who may not necessarily have previously worked together"* (Howarth, 2019: 81). In a review of literature on the effects of co-production, Vanleene et al., (2015) highlights multiple (perceived) benefits: (a) *better services* (e.g. cost-effectiveness, quality, satisfaction, performance), (b) *relationships* (e.g. learning, trust, consideration of clients/citizens' needs), and (c) *better democratic quality* (e.g. empowerment, fairness and equity). It is for such reasons that participatory engagement is increasingly discussed within national media as a way to build trust within UK politics, especially around controversial issues like climate change (Stewart, 2020).

Excitement and interest around participatory engagement has become of particular interest within the realm of climate change communication, where practitioners often highlight a need to get away from 'one-way' communications approaches, like lectures and public presentations, instead building dialogue, narrative, and conversation (Corner, 2016; Corner & Clarke, 2017b; Marshall, 2014). Enhancing participation in political decision making around climate change has been a key demand of climate activist

[9] Note there is an interesting tension here also with aforementioned research on Social Impact Theory (Latané, 1981), which suggests behaviour changes when there is pressure to respond to the requests, needs or demands of many people.

groups, including Extinction Rebellion, and other notable environmental organizations[10]. As noted earlier, several cross-parliamentary committees have funded a program of citizens' assemblies (a form of policy co-production), to advise government on key issues around transitioning to a low carbon economy.[11]

Co-production activities are also increasingly viewed as important to the process of adaptation and building resilience to emerging climate change impacts. As explained by Howarth & Morse-Jones (2019: 65):

> "Co-production provides a constructive way to deliver more salient decision-making processes which incorporate the needs of those affected in managing and responding to nexus shocks."[12]

Co-production allows communicators and policy makers to exchange information about climate change in ways that:

- Are non-threatening;
- Bring the public along;
- Better incorporates user needs;
- Appeals to people's values and self-identities rather than just short term interests;
- Better incorporates localised knowledges;
- Makes the issue of climate change less distant and more tangible (see: Howarth, 2019).

Participatory approaches related to adaptation include public consultations in Fairnebourne in Wales where the village is at serious risk from sea level rise (CCC, 2018); Catchment Partnerships and participatory learning projects bringing together local and expert knowledge around flooding in Cumbria (WCCP, 2020) and Devon (Barr & Woodley, 2014); and the use of citizens' assemblies in Poland to inform policy decisions around flooding (Gazivoda, 2017).

While the potential for participation and co-production to improve climate communication appears clear, scholars have highlighted that there is little consensus about what co-production really is, why it is carried out, or how best to achieve outcomes it is said to evoke (Oliver et al., 2019). Furthermore, to date, no studies appear to have provided clear *comparative* evidence about the efficacy of co-production in achieving desired outcomes, relative to other alternative approaches. Scholars have also highlighted potential risks of co-production (e.g. from lack of impact, stakeholder dissatisfaction, or challenges of negotiating stakeholder biases – Vanleene et al., 2015); as well as

[10] See for instance: https://rebellion.earth/the-truth/demands/
[11] See: https://www.climateassembly.uk/
[12] 'Nexus shocks' are impacts to complex human-environmental systems that have wide reaching impacts, including climate hazards, such as floods, wildfires, droughts (and so on).

potential costs, including practical costs (e.g. admin burden), personal costs (e.g. interpersonal conflict) and costs to stakeholders (e.g. sacrificing time; Oliver et al., 2019). Literature considering many of the complexities and challenges of co-production is still in its infancy, and clearer recommendations for practitioners are clearly required. The opportunities and challenges of co-production will be raised and discussed further in the thesis, especially in *Chapter 8,* where experiences of co-production will be discussed reflexively.

2.5 To threaten or not to threaten? Towards a new integrated model for communicating adaptation

The broad pattern observable in the past literature is that, at the individual level, a heightened sense of threat (i.e. high perceived vulnerability and severity), balanced with a heightened coping appraisal (i.e. high efficacy; low perceived response costs) tends to promote adaptive responses to climate hazards. Without a sufficient coping appraisal to match a sense of threat, individuals are likely to feel overwhelmed by fear and worry, or practice maladaptive coping, like denial or avoidance. This pattern echoes similar evidence in health communications (Floyd et al., 2000; Peters et al., 2013; Witte & Allen, 2000). Despite this, research has shown that news media communications about climate change typically induce 'threat without efficacy', as impacts and actions are rarely discussed in the same broadcast (Hart & Feldman, 2014). This suggests current climate communication practices inadequately appeal to both threat and coping appraisals.

While the balance of threat and efficacy broadly appears important, the literature also highlights a range of distinct threats that individuals can experience as part of, or in addition to, heightened risk perceptions. These include existential threats (Fritsche et al., 2010), identity threats (Breakwell, 1986), intergroup threats (Stephan & Stephan, 2017), values threats (Kahan et al., 2011; Stern et al., 1995) and freedom threats (Brehm, 1966, 2000). In turn, while some individuals may perceive the hazards of climate change (e.g. flooding, heat stress and wildfires), as exacerbating one or more of these threats, other individuals with dissimilar worldviews may perceive the responses required to combat climate change as the source of such threats. Also, as highlighted in this review, other factors, such as social norms, trust and place attachment are important for promoting adaptive responses to climate change. These factors are also likely to incorporate an element of perceived threat as well - such as the threat of being outside the norm (Cialdini & Trost, 1998), or wishing to preserve a valued place from the threat of significant change (Devine-Wright, 2009).

Communications may also inadvertently pose threats towards values, freedom, or identities, in ways that induce maladaptive coping among certain groups. In such cases, this misplaced sense of threat can promote maladaptive responses such as denial, or reactance. Communications which are framed to resonate with values and needs, rather than threatening such factors, are therefore suggested by some scholars to be more efficacious. However, communications approaches may also create threats in a

constructive way - for instance, by increasing risk perceptions, through criticism of actions, sustained pressure to respond, or illustrating how inaction on climate change threatens values - promoting adaptive coping. This leaves a dilemma for climate communicators about whether *'to threaten or not to threaten?,'* how to position threats correctly in order to facilitate climate actions, and how best to nurture adaptive responses. These questions will be returned to throughout the thesis; and especially in the thesis discussion *(Chapter 9).*

2.5.1 Model selection

The patterns in the literature pose a challenge for selecting an appropriate theoretical framework for communicating adaptation. Any ideal model would incorporate significant aspects of the literature above, making it suitable for both explaining adaptive responses to climate hazards, as well as responses to communications. The model should also operationalize variables so that empirical research can measure factors to predict behaviour.

A range of theoretical models have been deployed to explain environmental and climate behaviours, which are highly useful for measuring and explaining intrapsychic mechanisms. Yet some appear to have more limited usage in this research context - as they do not sufficiently address the range of factors covered in this review. For instance, the *Theory of Planned Behaviour* (TPB)(Ajzen, 2011) is the most commonly utilised model in environmental psychology (Klöckner, 2013, 2015). This model proposes that personal attitudes, descriptive norms, and perceived behavioural control produce intentions, and then behaviours. While norms are likely to be important as noted earlier, and behavioural control is related to the concept of efficacy, the model is limited in that it does not directly operationalize attitudes as threat-relevant. Other models incorporate a larger number of factors, yet still are not well suited to the needs of this research project. The *Comprehensive Action Determination Model* (CADM; Klöckner, 2013) for instance, proposes that factors relating to normative processes (e.g. social norms, personal norms), intentional processes (intentions and attitudes), as well as habitual and situational factors influence ecological behaviour. However, again, this model does not typically include threat or efficacy variables. It would not be inappropriate to test these models in relation to adaptation - but such models do have clear theoretical limitations relative to other models, a-priori.

Some models are perhaps better suited to explaining how individuals cope with climate threats. The *Values-Beliefs-Norms* model (VBN; Stern et al., 1999), which builds on *Norm-Activation Theory* (NAT; Schwartz & Howard, 1981; Schwartz, 1977), posits that a sense of obligation to take pro-environmental action is influenced by an awareness of threat to 'valued objects' (i.e. that which is considered important in life), and perceived ability to reduce that threat, plus a sense of obligation to act. This suggests it would be a useful model to make sense of any values-based influences on adaptation behaviours. However, the role of values in adaptation is disputed (as noted earlier) - and so this model may be more relevant to studies addressing mitigation alone, or other pro-

environmental behaviours. Other, more conceptual models, such as the aforementioned *Identity Process Theory* (IPT) (Breakwell, 1986; Jaspal & Breakwell, 2014), explain how threats towards identity needs can influence behaviour. This model is also potentially relevant, as both climate hazards and interventions may pose identity threats - and the model has been used to explain responses to communications interventions. However, the model is not clearly operationalized for measuring constructs quantitatively in relation to adaptation.

A further model of relevance is *Protection Motivation Theory (PMT*; Maddux & Rogers, 1983; Rogers, 1975). Studies about the factors that influence adaptation often stem from, or make sense in relation to PMT (van Valkengoed & Steg, 2019). PMT appears to be the most widely used framework for individual adaptation actions, given its core features cover threat and efficacy factor. The framework was originally developed to understand responses to fear appeals within health communications, and has been widely applied to explain coping with health threats, such as smoking cessation, healthy eating, and sexual health (Floyd et al., 2000; Rippetoe & Rogers, 1987; Witte & Allen, 2000). PMT posits that there are two key appraisal processes that motivate adaptive responses to a threat (See *Figure 2.5.1*). These processes are 'threat appraisals' (i.e. one's beliefs that there is a present and significant threat) and coping 'appraisals' (i.e. one's sense of being able to respond effectively, with minimal costs). Together, these threat and coping appraisals are suggested to influence adaptive responses (i.e. a 'protection motivation behaviour') towards health threats and other issues.

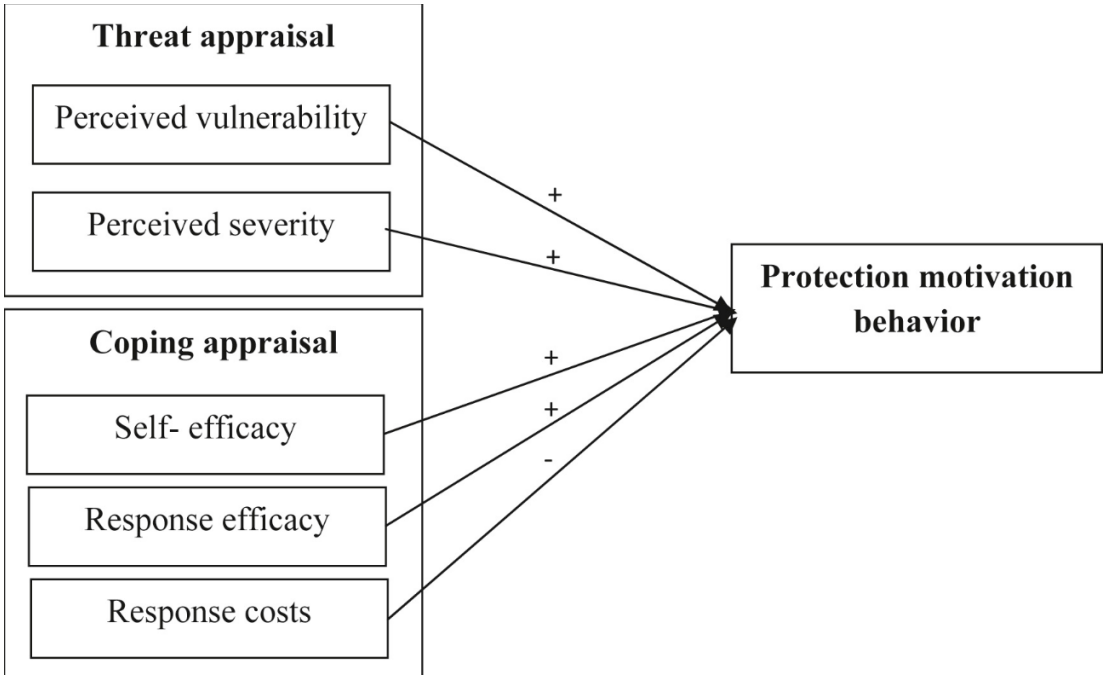


Figure 2.5:1 *- The Protection Motivation Theory model, as applied in a recent study related to adaptation behaviours; from: Keshavarz & Karami (2016).*

Despite the original health focused conception of PMT, it has been widely applied within environmental stress studies related to climate adaptation. This transfer has been advocated due to PMT's ability to help explain different individual-level behaviours in different climate hazard contexts, such as flooding (Fox-Rogers et al., 2016), wildfires (Hall & Slothower, 2009), and drought (Keshavarz & Karami, 2016). PMT certainly has limits in that it does not cover the diverse range of threats that have been illustrated in this review, and it also does not incorporate some of the other relevant factors like trust and social norms. Furthermore, while some variants of the model include sources of information (e.g. verbal persuasion, and observational learning – see Floyd et al., 2000) the model lacks clear information about how communication level factors interact with the threat and coping appraisal dimensions. However, its threat and coping factors are clearly relevant to this project; are operationalizable (e.g. through pre-existing, validated measures); and its implications have been used to inform a range of communications interventions (see: Witte & Allen, 2000). Furthermore, PMT has been *adapted for adaptation* research in several ways, with scholars adding further explanatory variables. Modifications have included the addition of direct experience, climate change perceptions and social norms to further explain adaptation behaviours (e.g. Dang et al., 2012; Grothmann & Patt, 2005). The task that these scholars commenced essentially concerns how to optimize PMT to better explain climate adaptation.

Criticism can be made about the act of extending existing models, such as PMT, VBN or TPB with the addition of further variables. For instance, the CADM, which combines several pre-existing frameworks has a very high chance of predicting *something* in any application – given it incorporates so many variables. In certain applications some CADM variables may also be unnecessary. This, in some ways, undermines the CADM's value according to the Occam's Razor heuristic (i.e. *entities are not to be multiplied without necessity* / *The simplest correct explanation is the best).* Furthermore, discussing TPB, Sniehotta et al. (2014) has argued that model extensions do a disservice to the novel ideas being added (given they are not being tested alone, but to support an existing explanation); and that aggregated models often take the original framework "well-beyond recognition" (p.4). In response, however, it seems a greater disservice *not* to build on relevant, well-tested existing frameworks, where such models have clear value already. As outlined in *Chapter 1,* this PhD aims to *advance* understanding of adaptation, to help *optimize* communications practices. It does not aim to disregard what is already known, or to reinvent the wheel where useful explanations already exist. While limited, PMT certainly appears a suitable starting point for such a task. Nevertheless, to evade theoretical myopia - given other theoretical frameworks discussed may prove to have greater value than could be ascertained a-priori - the precise model selection will remain as an open question at the start of this thesis, and will be addressed further through empirical research in *Chapter 3*.

2.6 Key updates to the literature

This final section addresses some of the most significant additions to the literature, which were published after much of this project's research and analysis had been carried out, but before the writing up was complete. These findings were therefore unknown at the initial and middle stages of this project. Nevertheless, they are important contributions, and are referred to at relevant points in thesis.

2.6.1 Which factors are most influential for adaptation behaviour?

A meta-analysis, published in 2019, investigated the relative influence of 13 psychological factors across 106 studies concerning adaptation behaviour (van Valkengoed & Steg, 2019). This work found self-efficacy, response efficacy, descriptive norms and negative affect to be the most strongly associated with adaptation behaviours (like information seeking, evacuation, policy support, and preparedness behaviours). Interestingly, the study found that knowledge, place attachment, experience and trust, had a more limited influence on adaptation. Risk perception, climate change beliefs, responsibility and injunctive norms had medium level influences. Of the factors considered, risk perception had a particularly variable influence. The study concludes that Protection Motivation Theory is an ideal model for addressing individual-level adaptation - given it incorporates risk perception, self-efficacy and response efficacy.

This work adds to the validity of this PhD's approach. It highlights the importance of attempting to understand adaptation from a psychological perspective and adds justification to the aim of extending previous research by assessing the relative influence of other factors like values, reactance and collective-efficacy. The work also showed that 'preparedness' was by far the most studied form of adaptation response, with evacuation, insurance, information seeking, and policy support being much less commonly studied. This adds validity to the approach taken in this thesis - where several types of adaptation behaviour have been considered throughout (e.g. personal preparedness, civic actions, and policy support).

However, the work is limited in that it does not investigate whether the influence of factors vary with different types of responses. For instance, it is possible that self-efficacy is associated with individual level adaptation behaviours (such as adding flood protection to one's household), but less so with responses like policy support, where the implementation is the responsibility of organisations or government. The work was also not able to incorporate the influence of personal values, or reactance, most likely due to the lack of adaptation studies assessing these. Furthermore, the study did not address how the factors may be implicated by communications.

2.6.2 Can different models better explain adaptation and mitigation?

New research has shown that different behavioural models may be more applicable to different forms of climate behaviour. Through research with over 1500 rice farmers in China, Zhang et al., (2020) find that the Values-Beliefs-Norms model (VBN) is better at predicting climate change *mitigation* (i.e. altruistic climate behaviour), while Theory of

Planned Behaviour (TPB) is better for explaining climate change *adaptation* (i.e. self-interest behaviours). This research showed that in VBN, the pro environmental personal norms construct explained 54.2% of growers' mitigation behaviours, but only 28.4% of adaptation behaviours; while TPB, behavioural intentions and perceived behavioural control accounted for 42.1% of farmers' adaptation behaviours, but only 25.6% for mitigation behaviours. This research highlights how different factors influence mitigation and adaptation, suggesting they should be studied discreetly. This is a useful finding, and suggests models centred on self-protection are better suited to adaptation (perhaps suggesting Protection Motivation Theory is also well suited). However, the operationalisation of adaptation as solely 'self-interested' is limited and is likely to have shaped these findings. Adaptation can include a broad range of responses from preparedness, through to policy support and civic action - that can benefit not just the individual but other members of society.

2.6.3 Public perceptions of adaptation in the UK (and communications guidance)

Findings from the RESil-RISK project published in 2020 provided substantial evidence about perceptions of climate impacts and adaptation amongst the UK public (Steentjes et al., 2020). Through a large-scale survey carried out in October 2019 (N=1,401), the research addressed a range of topics relating to adaptation (and mitigation), including risk perceptions of climate change impacts, experience, and support for actions and policies. The survey therefore provides the most up to date descriptive statistics for UK perceptions related to these themes, and compared with past surveys highlights how some perceptions have shifted.

Of particular note, the survey found that storms and flooding remain the highest perceived risks, and are seen to be likely to increase in the future; although risk perceptions about extreme heat largely increased since 2013. The role of direct experience and personal susceptibility were highlighted as key, as a substantial majority (70%) said they, or someone close to them, had experienced discomfort during a heatwave, and more thought they were at risk of heat-stress than flooding. Compared to 2016, negative affect has generally increased, with around a third of respondents feeling fear or anxiety when they think about climate change. Social norms related to climate action have also increased since 2016. There was very strong support (≥67%) and little opposition (≤8%) to the range of adaptation policies surveyed (such building regulations, new water reservoirs, and flood defences).

Alongside this survey, new guidance was published about communicating impacts and adaptation (Corner et al., 2020). This included key recommendations to show how risks are relevant to people's lives; build efficacy by highlighting practical actions; and tap into concern around extreme heat to open up engagement. Given that the survey found no difference in support for mitigation or adaptation, the authors also note that communication can combine mitigation and adaptation information without undermining the message, or confusing the public. The guidance also recommends avoiding the

terms adaptation and mitigation, as most members of the public do not make this distinction. Interestingly, the guidance includes a suggestion to relate impacts to widely shared values (i.e. values-based engagement). Given the role of personal values remains unclear in relation to adaptation - further research may still be required to validate this recommendation.

2.7 Conclusion

This literature review has highlighted a range of research that helps explain adaptation behaviour, and the influence of communications. The factors that have been used to explain adaptation include *threat appraisals* (risk perceptions, direct experience, and climate change perceptions), *coping appraisals* (efficacy variables and perceived costs), as well as *other factors* (social norms, values, trust and place attachments). The research to date suggests a balance between an increased threat appraisal and coping appraisal supports personal adaptation behaviour. Other factors noted gave somewhat mixed results or were limited in research, meaning further research will be useful to clarify their roles. Additionally, communications level factors may influence how well individuals respond to interventions, though further research is needed to understand the roles of threatening vs. non-threatening communication styles; imagery and co-production. In turn, given the consistent but complex theme of threats, a range of models could be applicable to this issue. As a first step, grounding a model selection in a real-world context will be a useful exercise, whilst addressing other outstanding questions.

2.7.1 Key literature gaps and research questions

Across this literature review, a range of key research gaps were highlighted. Not all of the research gaps can possibly be addressed within the scope of this project. At the same time, as noted in *Chapter 1*, this thesis aimed to be incremental, with research questions and hypotheses evolving during the project. The following list details the questions addressed in subsequent chapters. While this list suggests questions have been ordered and approached a-priori, the order of this list has been arranged here following the research, for ease of reference.[13]

1. *Which social-psychological factors appear to be salient in shaping experiences, attitudes and behaviours related to a recent flooding event in Cumbria, UK; and how might this knowledge inform communications aiming to encourage climate change adaptation? (Chapter 3)*

2. *Which socio-psychological factors are most influential for adaptation relevant behaviours and policy support in the UK? Which forms of efficacy (e.g. self, response, collective, political) have the most substantial influence on individuals support for policies and intentions to carry out behaviours related to flooding and climate change? (Chapter 4)*

[13] Question wording has also been adapted here, for simplicity. Please refer to relevant chapters for exact question wording.

3. *What are the roles of majority and minority status in determining responses to behavioural criticism? How can support for maladaptive responses be addressed through (non)threatening communications? (Chapters 5 & 6)*

4. *Which health impact framings of climate change heighten threat appraisals the most? Which factors influence behavioural responses to health impacts? What is the role of imagery for framing climate change as a health issue? (Chapter 7)*

5. *What recommendations can be made about communicating adaptation through collaborative engagement activities (e.g. co-production) and nurturing efficacy? (Chapter 8)*

6. *Based on the completed work, should communications aim "to threaten or not to threaten?" Can an optimal model for communicating adaptation be provided? What recommendations, and broader implications can be drawn from this work? (Chapter 9).*

In turn, the following chapter explores how peoples' experiences of recent flooding can inform the communication of climate adaptation.

Chapter 3

"We needed to be able to stand alone": Interviews with residents affected by the winter 2015/16 floods in Cumbria, UK

Image: "Aerial footage of Keswick, Cumbria, following storm Desmond", by Adamedia (image reproduced with permission)

3.1 Abstract

Flooding is expected to be a particularly disruptive climate change impact in the UK, requiring substantial public engagement to foster adaptive responses. A range of literature has addressed people's experiences of flooding events. However, very few qualitative studies have focused specifically on the psychological and behavioural dimensions of experiences to better understand how to communicate climate change adaptation. Additionally, previous research has typically been carried out several months or years after flood events. This exploratory chapter aims to explore flood experience to help understand the salient issues underpinning individual-level adaptation behaviour and policy support, and to contextualise findings in relation to climate communication. Semi-structured interviews (N=14) were carried out in Cumbria, very shortly after the 2015/16 winter floods. Through inductive thematic analysis, the chapter discusses several salient themes including *self-efficacy*, *polemic support for dredging*, *reactance*, *belonging*, and *mixed perceptions of climate change*. Novel contributions are made by drawing links between the key themes, psychological theory, and climate communications practice. Additional theoretical contributions are also made about *common psychological stages of flood experience*, and decision making when there are competing threats. The chapter concludes that findings can be best interpreted through Protection Motivation Theory (PMT), although further research is needed to extend this model and address other pressing questions that emerged during the analysis.

Highlights

- Interviews were carried out with 14 people affected by flooding in Cumbria, UK, following the winter 2015/16 storms.
- The need for self-efficacy was a particularly salient theme, though other forms of efficacy were observable, including collective-efficacy, and response-efficacy beliefs about the effectiveness of dredging.
- Flood victims' psychological needs appeared to be threatened by both flooding and engagement carried out by the authorities, leading to reactance.
- Protection Motivation Theory (PMT) helped to explain findings, though further work could usefully adapt the PMT model to help assist communicating adaptation.

3.2 Introduction

Flooding in the UK poses a range of significant threats towards people's physical and mental health, and impacts property, infrastructure, public services, and the wider economy (Ramsbottom et al., 2012). According to a review in 2008, 5.2 million properties in England, or one in six properties, were at risk of flooding (Environment Agency, 2009). These risks are anticipated to become more significant in the future, due to changes in rainfall and sea level (CCC, 2017, 2018), increasing annual losses from about £1.2 billion today, to between £1.6 and £6.8 billion by the 2050s (Ramsbottom et al., 2012). Despite this, the government have reported that, of the millions of households at risk of flooding, only 10% believe they are at risk or have a plan for how to respond (Curtin, 2017). This highlights a clear gap in perceptions, and the need for better communications around flooding risks in a changing climate.

Over recent years, the UK has been hit by a succession of high magnitude flood events (HM Government, 2016). Studying public experiences of such flood events can help to provide insights into the myriad socio-cognitive, behavioural and communications issues that will continue to be of relevance as societies adapt to climate risks into the future. Specific events have a fundamental importance in adaptation research, given they can act as been threshold events catalysing reactive adaption (Adger et al., 2012), and can help to inform better responses to disasters in the future (Spiekermann et al., 2015). Given that local, public knowledges are considered as an intrinsic, yet often overlooked, resources for climate adaptation (IPCC, 2014), understanding people's lived experiences of hazards helps to ensure that experiential knowledge is translated into better management practices. In turn, this chapter was developed in response to a significant flooding event, which occurred unexpectedly during the very early stages of this PhD.

3.2.1 The winter 2015/16 floods

In the winter of 2015/16, a series of storms (*Desmond - 5th*, *Eva – 9th and Frank -29th of December*) led to severe flooding in parts of Great Britain and Ireland. The event was predominantly fluvial, following unprecedented rainfall in parts of the UK (see *Figure 3.2.1*). The worst affected regions in Great Britain included Cumbria, Greater Manchester, Lancashire and West Yorkshire, in northern England, as well as Aberdeenshire and Dumfries in southern Scotland (Met Office, 2016). At least 20,000 properties were flooded (leaving thousands without power), hundreds of people were evacuated and widespread infrastructural damage was sustained, with preliminary estimates of £1.5bn in damages (HM Government, 2016; Priestley, 2016). There were two fatalities reported - one in Cumbria and one in Northern Ireland (Priestley, 2016).

The county of Cumbria was particularly impacted. During storm Desmond, a new 24-hour rainfall record (341mm) was set for the UK at Honister Pass, Cumbria, whilst all the main rivers in the county exceeded the highest recorded levels (Priestley, 2016). Cumbria was the worst hit county council, requiring £175m in infrastructure repairs due to significant road, bridge and landslip damage (Press Association, 2016). Similarly to the 2013/14 floods which significantly affected southern parts of the UK (see: Schaller et al., 2016), analysts found that precipitation rates of the 2015/16 storm events had an increased likelihood due to anthropogenic climate change (Otto et al., 2018).

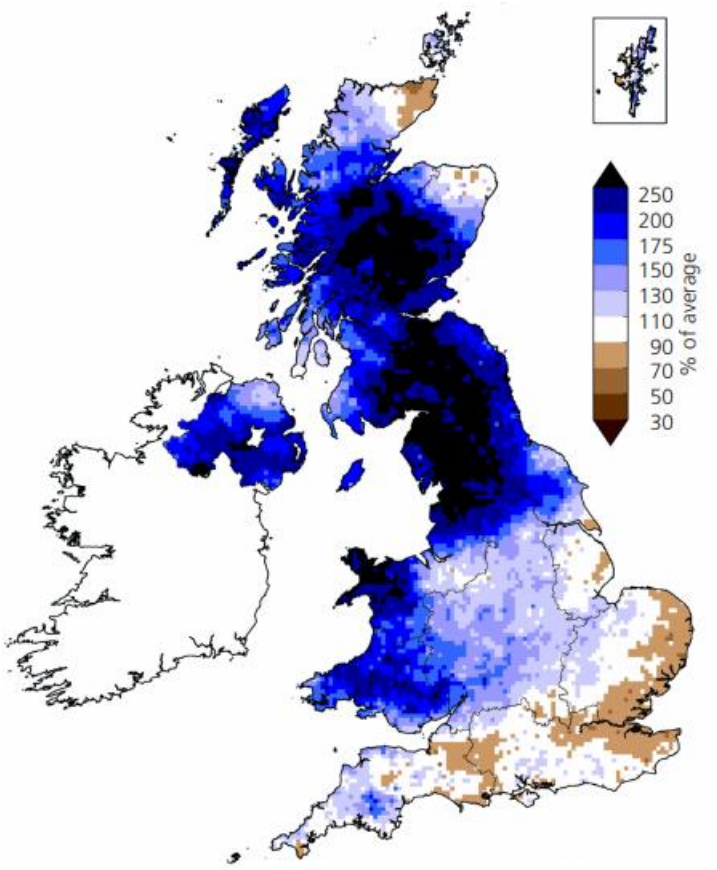


Figure 3.2:1 *- Rainfall anomaly map (% of 1971-2000 average) for December 2015. This map shows that several regions, especially in the north of England and Scotland, experienced >250% of the 1971-2000 average rainfall during this month. Source: (Marsh et al., 2016: 6).*

3.2.2 Analysing flood experiences to inform communications

Past research has addressed public experiences of flooding, giving detailed insights into determinants of protective behaviours, wellbeing, and climate perceptions (Adger et al., 2012; Aerts et al., 2018; Bell & Tobin, 2007; Fillmore et al., 2011; Fox-Rogers et al., 2016; Walker-Springett et al., 2017). Such research has shown, for instance, that Cumbrians experienced a greater sense of willingness to adapt their homes to flood risks following the 2009 floods, compared to residents in a second sample site, in Galway, Ireland (Adger et al., 2012). This perhaps suggests particularly useful lessons can be learnt about the determinants of adaptive responses in Cumbria. More limited research has specifically addressed the communication of flood risks in relation to climate adaptation. Messling et al., (2015) draw on workshop evidence to suggest that climate communicators should engage sensitively with people who have been affected by flooding and must empower people to respond and adapt. However, further research is needed to understand precisely *how* to empower people to adapt through communications interventions, by increasing our understanding of the psychological drivers of adaptive (and maladaptive) responses. This chapter builds on the evidence base by using an interview methodology to gain a deeper understanding of experiences, behaviours and relevant salient psychological themes, with a view to help guide the design of communications interventions.

3.3 Research aims

To build on the evidence base, the purpose of this explorative study was to:

1. Understand how recently flooded residents in Cumbria construct experiences of the issue of flooding (including perceptions of floods management and climate change).
2. Identify particularly important socio-cognitive and affective themes associated with climate adaptation and related communications practice.
3. Infer some initial suggestions for good communications practice based on this information.

Given the winter 2015/16 floods occurred in the early stages of this PhD, during literature review scoping, this chapter should be viewed as exploratory, and complimentary to the literature review *(Chapter 2).* By addressing public experiences of the flood event, this chapter also aimed to:

1. Help identify and refine key theoretical and applied research questions for subsequent chapters in this thesis, by contextualising questions in relation to a real-world climate hazard.
2. Guide the selection of a theoretical framework or model suited to the broader PhD topic.
3. Provide first-hand research experience of an unfolding flood event related to climate adaptation in the UK – helping to gain a more rounded appreciation of the most salient issues and challenges at hand.

3.4 Research question

The broad research question for the chapter, fitting with the above aims was:

RQ 1: *Which social-psychological factors appear to be salient in shaping experiences, attitudes and behaviours related to a recent flooding event in Cumbria, UK; and how might this knowledge inform communications aiming to encourage climate change adaptation?*

3.5 Methods

3.5.1 Ethics

This study was granted full ethical approval by the University of Bath Psychology Ethics Committee (Ref:16-003), via expedited 'Chairs Action', given the short time scale within which data needed to be collected. Participants had to be over the age of 18 to participate. Before engaging in an interview, participants read over an information sheet and signed a consent form. Following the interview, participants were offered a debriefing sheet, which contained information about the research interest in climate change communication. The document explain that this information was withheld to avoid biasing responses around climate issues. The debriefing also signposted flooding resources and mental health services in the local area. No incentives were offered to participants.

3.5.2 Interviews

Interviews were identified as an appropriate method for perceptions of flooding, as this approach is useful for study that considers experiences; for exploring and identifying influencing factors; and when a participant has a direct stake in the topic of interest (Braun & Clarke, 2013). Other qualitative methods, such as focus

groups, or workshops have been used in similar research contexts (e.g. Messling et al., 2015). However, interviews were selected to allow for greater depth around individual-level experiences, given this was considered as particularly important for this study. Other, more positivist, methods, such as a quantitative survey or an experimental study, were not suitable, as it would have been impossible to know precisely what to measure, given this was an exploratory study. In turn, interviews were conducted with 14 participants. Interviews took place in participant's homes, workplaces, or a convenient location (e.g. a local community centre). The duration of interviews was 20-50mins, depending on the level of detail participants wished to give. One interview was conducted as a joint interview, upon request. For this joint interview, extra effort was made to allow participants to clarify if they held similar or differing views.

Interviews were semi-structured, allowing room for the interview discourses to flow more naturally, for the interviewee to elaborate on interesting points and for the interviewer to investigate certain ideas in more detail (as suggested by: Braun & Clarke, 2013; Bryman, 2012; Mason, 1996). An interview schedule, with specific questions, was developed after identifying potentially important themes. The following questions were asked, always beginning with question one (below), to allow open-ended responses about experiences of the floods. This was intended to minimise interviewer bias – where certain themes or issues can be made immediately salient at the start of an interview (Walker, 2015: personal communication). The other questions followed generally in the structure below, though variations were made according to the development of each specific interview. The semi-structured interview questions were:

1. Please can you tell me about your experience of the floods?
2. What do you think caused it?
3. How did you initially hear about the flood risk?
4. How do you feel the floods were handled by the authorities?
5. How do you think this can be prevented in the future?
6. Do you think it's likely to happen again?
7. Do you think these floods have anything to do with climate change?
8. Do you think climate change could make floods worse here?

Questions were designed to be open ended, and use appropriate interrogative words of '*how'* and '*what'*, and to tap into '*feelings', 'meanings'* and '*experiences'* (Braun & Clarke, 2013). '*Why'* questions were generally avoided, based on advice that such questions are often unfruitful, and can stagnate the flow of an interview (Braun & Clarke, 2013; Nevid, 2015). However, such questions were asked when deemed appropriate to investigate specific details in the conversation. Open ended questions were used so as not to bias the answers participants gave, and enhance the flow of responses (Silverman, 2013). Leading questions were avoided when deviating from the interview structure, for the same reason (Bryman, 2012).

Following guidance about avoiding sources of potential bias while conducting interviews (e.g. Braun & Clarke, 2013; Silverman, 2013) *climate change* was not

mentioned until the final part of the interview. The intention here was to allow participants to define the key issues relating to the floods in their own terms, and to see if any attributions to climate change were made without the researcher prompting or biasing answers.

3.5.3 Locations

Figure 3.5:1 *- The five sites at which interviews were carried out in Cumbria, UK: Keswick, Carlisle, Glenridding, Eamont Bridge and an isolated settlement near to Appleby-in-Westmorland (note, the exact locations are not detailed to protect participant anonymity). Custom image. Original sources: Google Maps (custom map) and ONS Open Data.*[1]

The research carried out took place in several sites in Cumbria: Glenridding, Keswick, Eamont Bridge, Carlisle and an isolated settlement near to Appleby-in-Westmorland (see *Figure 3.5.1*). These sites were identified as having been significantly affected by the winter 2015/16 floods, according to news media reporting (e.g. BBC News, 2015) and local knowledge attained while recruiting participants. A diversity of sample sites was considered so that research could analyse patterns in data attained across a range of different locations, impact severities, and socio-economic contexts, within Cumbria.

3.5.4 Recruitment

Participants were selected for interview because they were affected by the recent flooding event. The criteria used to define this was based on Capstick et al.'s (2015) research in relation to the 2013/14 UK floods. Participants were required

[1] The ONS image was licensed under creative common (CC-BY-SA 3.0), and available via: https://www.ordnancesurvey.co.uk/opendatadownload/products.html

to have direct experience of flooding itself, or their local area was affected within 15-20mins walking distance from their home.

Recruitment was conducted through convenience and snowball sampling (Bryman, 2012). For instance, door knocking was carried out near to flood sites in the village of Glenridding, where specific locations were identified via local information (e.g. speaking to local shop owners and residents) as well as visual markers (e.g. clear evidence of flood damage). Other participants shared the same workplace or were involved in a shared community group.

Participants were asked if they would like to talk about their views on the recent floods. It was made clear that as an independent PhD researcher, no official agencies involved in flood response were being represented (e.g. local government, environment agency etc.). An audio recorder was used to capture the interviews, which were later transcribed.

Recruitment was terminated earlier than planned, due to ethical concerns about approaching residents for an interview in the aftermath of a flood. While many individuals who were approached were happy and eager to discuss the floods, a small number of people expressed frustration at being asked for interviews following the flood event (having also been approached by newspapers and news media). Therefore, it was decided that to avoid unwanted door knocking, the interviews should be terminated.

Despite this, while interviews were carried out with 14 individuals – the interviews did appear to reach a point of 'saturation', where similar topics and opinions were (almost predictably) being expressed in each interview towards the end. This was especially true in relation to interviewees expressing support for 'dredging' (see findings and discussion below). A saturation point such as this is often recommended as a suitable gauge for terminating the recruitment process for interviews (Braun & Clarke, 2013), and therefore the termination due to ethical reasons can be viewed as not-entirely disrupting the normal research process.

3.5.5 Participants

Across the participants, only two interviewees (in Glenridding) were not directly flooded in their homes, but lived in close proximity to the flooding, and were significantly disrupted by the event. All other participants' homes were flooded directly. While demographic information was not systematically collected, effort was made to recruit participants of a range of ages (c. 20-70 years), and a mixture of socio-economic backgrounds.

3.5.6 Temporality

Data collection was conducted between the 11th and 15th of January 2016 meaning the first interviews were 37 days after the first floods on the 5th of December 2015, and 13 days after the last flood on the 29th December. Past research on public perceptions of flooding (e.g. Adger et al., 2012; Messling et al., 2015; Walker-Springett et al., 2017) has typically taken place several months to years after the events – so the time scale adopted adds novelty here.

This short time scale was considered to increase the ecological validity of the study (Bryman, 2012). Firstly, in terms of memory - the time scale allowed interviewees a greater ease of recall, and a better chance of giving more precise recollections of events. Psychological study has shown that memories of events

can be shaped by a range of biases (e.g. Levine & Safer, 2002; Rozin & Royzman, 2001). In turn, it is possible that individuals' recollections of flooding events could be influenced, perhaps distorted by exposure to media stories, or other people's recall of events. Carrying out interviews shortly after the event was considered more ideal than a longer time scale. Any common themes that emerged were anticipated to be the result of several independent experiences – rather than a collective story that had emerged in the weeks or months afterward.

In addition, the short time scale was also potentially illuminating in terms of psychological implications, given it was more likely to be a period of heightened affective meaning. Again this was anticipated to add to the potential 'truthfulness' of the data (Bryman, 2012). Finally, as noted above, the short time scale also offered an opportunity to get first-hand research experience of the floods – helping to understand the context, issues and challenges first-hand. Climate change is increasingly described as a *lived experience* (e.g. Rowson & Corner, 2014), and experiential knowledge is often considered to be extremely important in public engagement practice (Howarth, 2019). Therefore, it made sense as a researcher to gain direct exposure to the flooding context, shortly after the event, to gain a more rounded understanding of the unfolding challenges and pressing issues facing individuals 'on the ground'.

3.5.7 Analysis

An *Inductive Thematic Analysis (ITA)* was utilised, based on guidance in Braun and Clarke (2013) and Bryman (2012). ITA is flexible to suit different research questions, theoretical frameworks and data collection methods, and its interpretive power is enhanced in partnership with a theoretical framework. Furthermore, it is suggested to be useful if findings are expected to be communicated to stakeholders and participants (Braun & Clarke, 2013).

Inductive thematic analysis shares similarities with *Grounded Theory (GT),* in that themes are identified across the data, through a bottom-up, data-driven approach (*Ibid*.). The outcomes are very similar to what would be expected from 'Grounded Theory-Lite' (*Ibid*.) However, it is different in that it acknowledges the researcher's prior knowledge of the field, standpoints and epistemology are somewhat influential in the analysis (*Ibid.*). This approach was identified as being appropriate, so as not to miss important details and to avoid simply cherry-picking information to match a theoretical framework.

Other approaches were valid also, but seemed less desirable for a highly exploratory study, which aimed to identify salient themes and then relate these to the most relevant theory. Interpretative Phenomenological Analysis (IPA), for instance, is very well suited to the analysis of lived experiences of significant life events. IPA coding may focus on what a given experience was like (phenomenology) and the meaning-making associated with it (interpretation). The end results of IPA and TA can often be very similar, however, IPA is more prescriptive in its approach to pre-defining theoretical frameworks, defining questions, and using a homogenous small 'N' sampling strategy (Smith et al., 2009). *Discourse Analysis (DA)* and *Conversation Analysis (CA)* were other options, however, these methods tend to be better suited to studies focusing on questions related to the use and meaning of language, discourses, and sociolinguistic processes involved in social interaction (see: Sidnell & Stivers, 2012; Wooffitt, 2011). CA also suggests setting up a preliminary hypothesis in

advance - and although these hypotheses can be modified and replaced during CA, it was still less desirable for an exploratory study. ITA was therefore viewed as a better suited approach for the needs of this study, than such options.

ITA involves a "systematic approach for identifying, analysing and reporting patterns [and] themes across a distinct dataset" (Braun & Clarke, 2013: 178). The process for coding followed stages of: *transcription*, *reading and familiarisation* (i.e. immersion in the data), *coding across the dataset* (on hard copy), *searching for themes*, *producing a thematic map*, *reviewing themes*, and *writing* (Ibid.). A *thematic framework* (i.e. subheadings added to transcript margins) was also created (see: Spencer, *et al*., 2014).

Codes were kept as concise and distinct as possible, and said something independently of the data, as if a statement in themselves (Braun & Clarke, 2013). Coding was inclusive, and areas of text were often highlighted with multiple codes. Example codes include: "*nothing you can do*", and "*criticism of environment agency*". After initial complete coding, these were reviewed to combine overlapping codes. Themes were identified by locating patterns, overlaps, recurrences and relationships between codes, through active investigation (*Ibid*.) Themes were distinguished from simple features in the data (such as 'gender'). In this, consideration was also given to the importance of *Saliency Analysis (SA)*, that is, something can be considered important without appearing very frequently in the data (Buetow, 2010).

Once initial themes had emerged, the most fitting theoretical framework was identified, by cross-referencing findings with literature, as is typical in ITA (Braun & Clarke, 2013).[2] It must therefore be noted that analysis took place in the absence of some theoretical insights that have since been integrated into the literature review, and the introduction to this chapter. In this sense, *top-down, deductive* thematic analysis was avoided, as this was deemed to increase risks associated with 'cherry picking' bias.

3.6 Findings and discussion

A range of emotionally charged, socio-cognitive themes emerged from the data. These themes illuminated the complex threats experienced towards interviewees' underlying psychological needs; the challenges of realising desired coping strategies, and anger about how they had been engaged with by the authorities. This section deals with each of the most salient themes: (*1) A strong need for self-efficacy, (2) Polemic support for dredging, (3) Reactance (4) A need for belonging* and, (5) *Mixed attitudes on climate change.* These themes are presented in a thematic map below (see *Figure 3.6.1*), which also notes related subthemes. The range of themes appear to be highly interlinked, though their relationships are also complex. To explore this thematic map, the themes will now be unpicked in detail, with supporting quotations presented. This is then followed by a discussion of theoretical models that may help to explain the findings.[3]

[2] The validity of this approach was also considered at length in discussion with the project's lead supervisor (Walker, 2016: personal communication)

[3] Please note that participant's quotations are provided in the format of: *Quote (Interview Number [Participant A or B for joint interviews]: Transcript Page Number)*

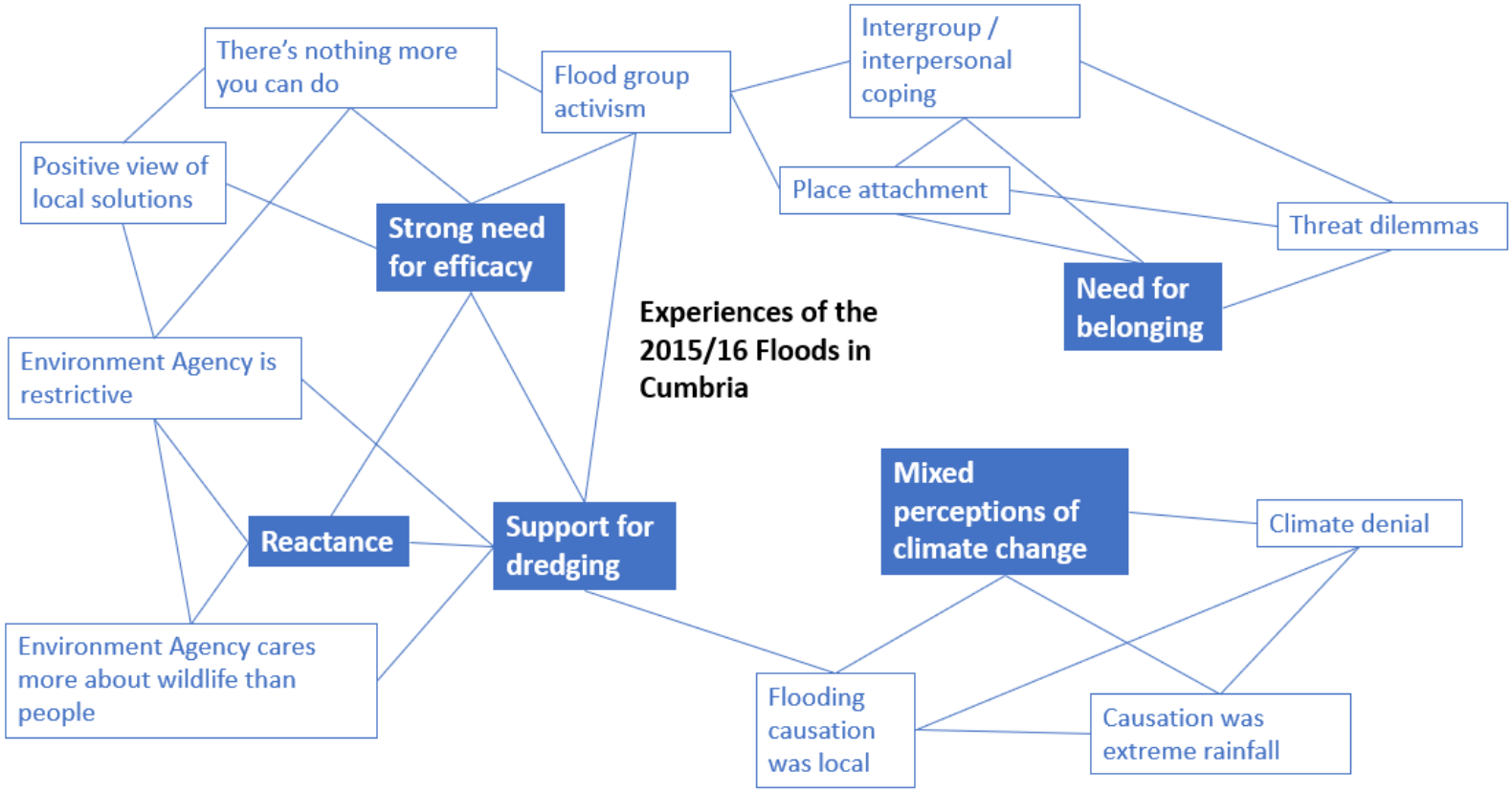


Figure 3.6:1 *- A 'thematic map', of the interviewees' experiences of the 2015/16 floods, showing themes and relationships that have been induced from the data. This figure shows the apparent interrelations between each of the key themes (dark blue) and subthemes (light blue), with lines indicating apparent relationships as induced from the data. This diagram should be treated as an illustrative map with qualitative associations, rather than a positivist model expressing causal relationships.*

3.6.1 A strong need for self-efficacy

The most salient theme to emerge from the data was a strong desire for self-efficacy amongst interviewees. Perceived self-efficacy was identified when participants discussed "beliefs about their capabilities to produce effects" (Bandura, 1994: 71) in relation to specific tasks, and "perceived capability for managing posttraumatic recovery demands" of the flood (Benight & Harper, 2002:177). Efficacy was coded when references were made to both the perceived ease, and lack of ease, with which people could cope with disruption caused by the floods.

The psychological need for efficacy was often tied to the threat of flooding itself, which significantly hindered, or disrupted the interviewees' ability to manage the flood risk. Numerous participants explained they were left feeling *there's nothing more you can do*, and this was often noted as a pre-cursor to a period of *waiting*. It appeared that those directly flooded were often left feeling helpless, and wished to reinstate a sense of control post-floods:

> *"…there was **nothing more we could do"** (I12: 6)*

> *"And erm I remember thinking at that time, **I can't watch this**. I'm gonna go upstairs. **There's no way I can watch it come in the house** so I came upstairs and **I just laid on the bed** and erm and then [my partner] came up and he was, he was like well **there's absolutely nothing, there's nothing we can do now**." (I7: 5)*

> *"…we decided then **there was nothing we could do, never felt so useless** and just had to give up and- […] err- we had to go upstairs and **just wait, and watch"** (I8: 2).*

In turn, numerous examples demonstrated a clear psychological need for greater efficacy to cope with the floods:

> *"…as volunteers we're quite well organised, we start saying […] **we want to be able to do this for ourselves**, we want to be able to close our flood gates, we want to be able to man the pumps […] You know, **we needed to be able to stand alone"** (I5: 4)*

> *"[A] few of us have had discussions about things and we think it would be a really good idea- each end of the valley, the Parish, is **have somewhere where there is a supply of sandbags, where there is de-humidifiers, where there is driers, where there is pumps**, **and if anything like this happens again, we have something**- and even if […] somebodies house has a burst pipe, **we have something here that will help and we're self-[sufficient]"** (I3a: 11).*

The experiences reported by interviewees make sense in relation to past literature surrounding self-efficacy, flooding and adaptation. Efficacy is considered to be an important precursor of adaptive responses to a range of threats, including responses to flooding, and when feelings of efficacy are hindered, this can increase avoidant coping, hopelessness and other negative outcomes (Hart & Feldman, 2014; Kievik & Gutteling, 2011; Maddux & Rogers, 1983; Rippetoe & Rogers, 1987; van Valkengoed & Steg, 2019; van Valkengoed & Steg, 2019; Witte & Allen, 2000). Previous work has noted that flood-risk preparedness can be undermined by low levels of efficacy amongst individuals, leading to the sense there's *'nothing you can do'* (Fox-Rogers et al., 2016). Other

work has noted a lack of agency (a similar sociological concept) is a common experience in the aftermath of a flood, and this can lead to anger and negative wellbeing outcomes (Walker-Springett et al., 2017).

It could be argued that participants responses concerned perceived control, rather than efficacy. Previous research suggests that individuals' 'locus of control' influences preparation toward hazards. For instance Robinson & Botzen (2020) report an association between intentions to take out flood insurance and an internal locus of control (i.e. feeling that outcomes of actions are personally determined, rather than down to external factors). This theoretical perspective seems transferable, given a desire was shown for personally controllable flood management. However, a distinction can be drawn between control and efficacy, in that the locus of control is typically measured in terms of cross-situational beliefs about event related outcomes, while self-efficacy concerns beliefs about task-specific competence (Bandura, 1977; Rose, 2020; Rose et al., 2010). Self-efficacy thus seemed much more applicable in the present research, given most interview discourse centred around perceived ability to carry out specific coping actions related to the floods, rather than consideration of whether hazards are within personal control, or down to fate or chance.

From another viewpoint, the apparent desire to have local capacity to manage the floods could be explained as an issue of perceived responsibility. Past research has drawn on such factors to explain adaptive responses in relation to comparable flood events. For instance, as noted above, Adger et al., (2012) found flood victims in Cumbria reported significantly higher personal responsibility to take action about flooding, than people affected in Galway. The paper argues that the social and legal context (i.e. social contract) over who has, or is perceived to have, control or responsibility for flooding is important in shaping perceptions of adaptive actions. Adger and colleagues research may help to explain the broader context surrounding the quotes above, given the interviewees also displayed a clear interest in managing flooding themselves. However, participants' responses seemed to be better explain in terms of efficacy, as actions were not framed by interviewees in terms of "duty" to take on "more responsibility"; or as a trade-off of responsibility between homeowners versus government (Adger, 2012: 332).

Despite this, the interviewees' responses certainly could not be separated from the broader socio-political context, or relational processes involving state and public actors (as suggested by Adger and colleagues). In fact, what seemed particularly important was that the great desire for efficacy appeared to also be associated with a perception that the authorities, especially the Environment Agency (EA), had reduced flood victims' ability to cope with the negative consequences of flooding. Thus, it is possible that the EA was being viewed as a direct threat, or barrier, to efficacy, resulting in a stronger desire for efficacy. It was often noted for instance that the EA was a barrier to effective responses, and that the lack of maintenance of rivers gave rise to further flooding:

> *"…the Environment Agency, which were **the only ones really that have a say or a nod**… (I3a: 13)*
>
> *"…the Environment Agency **weren't allowing us** to close the flood gates" (I5: 4)*

These themes were often tied to a subtheme that *the Environment Agency cares more about wildlife than people*:

> *"Environmental agencies **never want you to dredge becks** because there **might be some crayfish** in, or for whatever reason" (I1:1)*

> *"…and we had **real issues with the Environment Agency** because obviously there's **a lot of crayfish**… **Before they would let [the company] start** on the river they had to check for crayfish…and had there been any crayfish, they would have had to get in and remove them" (I7: 12-13)*

Adding weight to this, one participant who did *not* experience the Environment Agency as a barrier to coping with the floods (in fact, quite the reverse), consequentially did *not* yearn for efficacy as much as several other participants, despite being very severely impacted by the flooding (eventually being air-lifted to safety):

> *"The **only time I wanted some help** was subsequently when we were flooded on the 22nd again... that is the only time I rung the Environment Agency, and asked if there was any chance of getting anybody to help us up here. And their words to me were, erm "I am sorry you are not in the zone and **you are on your own**." (I12: 11-12)*

This is significant because it suggests that the way people in flood communities were being *engaged with* inhibited their perceived ability to mitigate the floods – threatening their sense of efficacy. In other words, people's efficacy in flood affected communities appeared to be inhibited, or disrupted, by the authorities responsible for managing the floods. This process of disruption is graphically represented as a set of contrasting feedback loops in *Figure 3.6.2* below, The diagrams depict how coping would ideally occur for an individual; and, where an external barrier (e.g. the EA) has disrupted coping, increasing efficacy needs.

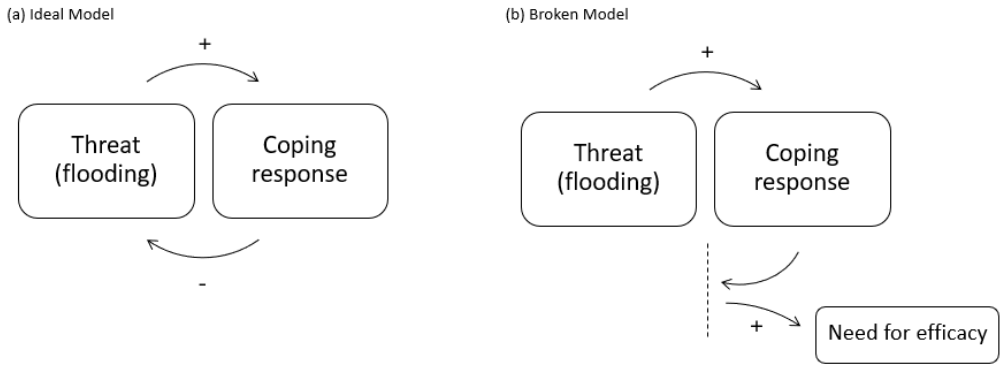


***Figure 3.6:2** - Ideal and broken feedback cycles of threat response. In (a) the 'ideal model', an increase in the threat of flooding increases (+) a coping response to mitigate the threat, which decreases (-) the initial threat of flooding – forming a 'negative feedback loop' (i.e. an increase in the initial component of threat / flooding is ultimately reduced, rather than exacerbated further). In model (b) the causal relationship that would allow personal action to reduce the threat is broken, due to the addition of an external barrier (the dotted line). This barrier could be overwhelming flooding levels, or restrictions by authorities. This break in the model increases the need for efficacy.*

The apparent impact of the EA on efficacy strongly echoes Walker-Springett et al., (2017), who report that institutional responses undermined people's agency in relation the 2013/14 Somerset floods. These research findings emerged independently around the same time, adding weight to the idea that this is a common experience in the UK. This also fits with suggestions that engagement around flooding, climate change and other threats should nurture a sense of efficacy, as those which do not tend to backfire (Fox-Rogers et al., 2016; Kievik & Gutteling, 2011; Messling et al., 2015). Though subtly different from efficacy research, other relevant work also highlights that when requests limit an individual's sense of freedom, these are also likely to backfire (Brehm, 1966; Dillard & Shen, 2005, 2013; Kronrod et al., 2012; Murtagh et al., 2012).

3.6.1.1 Self or collective efficacy?

While the need for self-efficacy was evident across many of the interviews (i.e. "feeling personally able/unable to do X"), there were also examples where *collective efficacy* (i.e. "together we can/cannot do X") was also salient. Collective-efficacy relates to group problems, requiring collective effort to produce significant change (Bandura, 1994). While participants tended to use personal pronouns (i.e.. "I", "me", "my") related to personal actions, some participants also discussed collective-level actions, using collective pronouns (i.e. "we", "us", "ours") to describe unified efforts. Collective efficacy appeared particularly salient in relation to community flood action activities:

> *"So the Flood Action Group actually fights for flood defences and looks at whatever measures need to be taken, and* ***it was us*** *that campaigned for the river defences […]* ***over the years we've achieved quite a lot*** *because we had the £6.1 million of flood defences built […]* ***we got two community pumps****, which can be, you know, taken to various areas in town where we've got surface area flood risk. So that helps […]* ***We've got a very good system for sort of like responding to floods*** *[…] there's about 14 of us that meet fairly regularly and discuss things and, and we, you know,* ***we've got a fair bit of money that we'd collected*** *before the river defences were done, which we've been holding on to, to pay for any sort of like* ***community contribution*** *that needed to be paid towards something." (I5:2-3)*

This is interesting as it would suggests collective efficacy also helps to promote adaptation, especially in relation to tasks where group actions were carried out as collective problem-focused coping. In some ways, this is in contrast to past research, which tends to draw more on the importance of self-efficacy as an antecedent to adaptive responses to threats and climate hazards (e.g. Maddux & Rogers, 1983; van Valkengoed & Steg, 2019; Witte & Allen, 2000). Relatively minimal research has focussed on collective efficacy in relation to flooding and climate adaptation behaviour. One study (with data collection in India) highlighted that individuals with heightened collective efficacy beliefs were more likely to participate in community adaptation activities related to water conservation (Thaker et al., 2016). More recent evidence from a national survey also shows that a majority of UK citizens agree that collective action would be effective for climate mitigation and adaptation (Steentjes et al., 2020). While not adaptation specific, other work has shown a key role of collective efficacy, alongside self-efficacy, in relation to climate activism in the U.S. (Doherty & Webler, 2016), and alongside social norms for electric vehicle acceptance (Barth et al., 2016). So, it

is certainly plausible that an effect of collective efficacy could be an influential antecedent of community level adaptation in the UK.

There was also a potential role of *political efficacy* here (i.e. feeling well informed about / able to influence decision making) – as individuals who were involved in collective actions also seemed to be particularly well versed in the political dimensions of flood management. This could be another important, yet under-researched, antecedent of adaption behaviour and wellbeing following floods, given research has found associations between political efficacy, civic participation, and community resilience in the face of adversity, in other contexts (Poortinga, 2012).

In turn, it would be of great use to further understand which forms of efficacy (e.g. 'self' or 'collective') are the most influential for promoting adaptive responses in this context. Isolating the most important form of efficacy could provide an invaluable knowledge about the antecedents of adaptive responses to flooding, and engagement design. However, this is something that inductive qualitative research alone is limited in being able to decipher robustly, and to disentangle this further would require deductive, quantitative work.

3.6.2 Dredging and response efficacy

Figure 3.6:3 - Dredging operations underway using heavy machinery at one of the study sites: Images: Niall McLoughlin

Whilst an array of possible flood management solutions were put forward by interviewees (e.g. upgrades to local water storage, bridge repairs, clearing of drains), by far the most common and passionately held belief was for significant *dredging* of the fluvial systems in Cumbria. The term dredging typically refers to the removal of accumulated materials from a riverbed, as well as straightening and/or deepening of a riverbed, and is sometimes practiced for the purpose of flood protection (CIWEM, 2014). Almost all participants mentioned that dredging would be a worthwhile response:

> ***"The only thing they can do** is they – they- **they can dredge the river and** also areas of the lake where they can get at it" (I2: 4)*

> *"Everybody's saying **'dredge the river, dredge the riverbed'"** (I8: 2)*

However, dredging is a contentious issue, given that it is not frequently recommended as a solution to UK flooding by experts or governing bodies. The EA, for instance, has explained that dredging is not effective for preventing flooding, and has a range of negative outcomes, meaning it is only beneficial in specific contexts[4] (BBC News, 2016; Weaver, 2014). One evidence synthesis report notes that while dredging has been shown to reduce river water levels and the duration that floodwaters remain on land in certain contexts, like the Somerset levels, it cannot prevent major flooding altogether and cannot be viewed as a stand-alone solution (CIWEM, 2014). Instead, dredging comes with significant risks without in-depth contextual consideration: It can accelerate the movement of flood waters increasing the risk of flooding for communities downstream; increase erosion; weaken river banks and infrastructure; reduce water quality; and significantly disrupt aquatic ecosystems and wildlife (CIWEM, 2014). Due to the infeasibility of dredging to mitigate major flood events of the sorts seen in recent years, and its negative implications, it seems reasonable to suggest that strong support for dredging is a largely maladaptive response the risks posed by flooding and climate change.

Yet despite this, there is often widespread support for dredging amongst UK flood affected communities. For instance, while hydrologists have reported that dredged rivers wouldn't have prevented the winter 2013/14 flooding in Somerset; social research carried out afterwards found that a "lack of maintenance of the river network" was perceived as the top cause of the floods (Butler et al., 2016:13). In this work, "96% of respondents believed that dredging river channels was very important or fairly important for flood risk management" (p.15). Various lobby groups[5] and articles in national media outlets have also advocated for dredging in recent years (e.g. Ball & Webster, 2019; Drury & Tozer, 2015), further highlighting the polemic support for dredging.

This raises an important question – why do individuals support dredging if it is often maladaptive? In one sense, dredging support tied in with a *positive view of local solutions* - that a localised ability to manage the flood was highly desirable:

> ***"Let all the farmers** who can on **their land** look after **their own waterways** and things and just keep it all nice and deep" (I3: 15)*

This may therefore have been associated with self and collective efficacy once more, given clear desires to have greater local influence on flood management. This explanation also makes sense given that other solutions proposed by interviewees also tended to involve making structural changes in the local environment (e.g. alterations to bridge structures, drain maintenance). Even solutions that were relatively further away tended to still regard the immediate

[4] The EA have noted that dredging is not suited to Cumbrian river networks: "On slow-moving, relatively flat rivers [dredging] can make a significant difference. What we have in Cumbria are very high energy, steep rivers so it's a different situation." (BBC News, 2016: npn).

[5] "dredge the rivers!" has been a key demand of various lobby groups. See for instance: http://www.flagsomerset.org.uk/

catchment area (e.g. reservoir improvements, upland tree planting). Few mentioned actions to mitigate climate change unprompted.

However, while a local solution orientation may help to explain support for dredging, the advocacy seemed better explained by a different form of efficacy – namely, 'response efficacy'. Response efficacy beliefs concern the *effectiveness of a response in reducing the threat* at hand. The relevance of response efficacy was noticeable in a common argument put forward in support of dredging - that historically rivers *were* dredged more readily and proactively than today, and this is what kept flooding under control in the past:

> ***"30 years ago somebody did that every year** under the bridge and everywhere around here, they d- **and there was never problems"** (I3a: 15)*

> *"…And the beck, because **they're never dredged"** (I1: 1)*

The causal connection implied here is that *by discontinuing dredging, floods have increased*. This isolates the idea that support for dredging is associated with beliefs about its *effectiveness* in negating risk. This analysis makes sense in relation to past research, as in addition to self and collective efficacy, studies have highlighted that behavioural responses to climate change and other kinds of threats are often associated with perceived effectiveness of responses (Floyd et al., 2000; Truelove & Parks, 2012; van Valkengoed & Steg, 2019). Nevertheless, support for dredging may also have been influenced by political efficacy. Participants who appeared to be more academically informed about flooding, or in greater contact with the Environment Agency (e.g. via a Flood Action group) appeared to advocate dredging less dogmatically, cited a range of possible solutions, and were (relatively) less negative towards the Environment Agency.

3.6.3 Reactance

Given the strong support for dredging, there was also a clear sense of anger that dredging wasn't being practiced more extensively to protect communities in the area. Again, many perceived that the EA were acting as a barrier towards this preferred form of coping. Interestingly, the EA's perceived 'anti-dredging bias' was frequently tied to a sub-theme across the interviews, where participants argued that *the EA values wildlife more than people*:

> *"…because **environmental agencies never want you to dredge becks because there might be some crayfish** in, or for whatever reason" (I1:1)*

> *"I think [the environment agency] **they're worried about** the – **the things that are supposed to be living in it."** (I4: 8)*

> *"I know there's a lot of concerns about the crayfish, but to be honest […] who's actually looked to see what crayfish are in there […] **the crayfish are being given priority over people's houses and lives"** (I8: 2)*

A similar framing of the EA was subsequently reported by Butler et al., (2016) in relation to the Somerset floods, suggesting this is a common perception in flood communities. Media commentators have also suggested that EU officials have "banned" dredging to protect wildlife, worsening the UK floods (Drury & Tozer, 2015). Given this, during the interview period, the EA were forced to defend their

commitment to protecting people over wildlife, with then PM David Cameron calling for an attitudinal shift in the organisation (BBC News, 2016a, 2016b)[6].

In turn, it seems possible that support for dredging may have even been exacerbated via this conflict between public and state actors. This might make sense in relation to aspects of Social Representation Theory (SRT - see: Jaspal et al., 2013; Moscovici, 1988). The strongly held beliefs about dredging in this framework could be considered as a 'polemic' social representation – that is, a passionately supported representation of a minority group (i.e. the flood-affected community). The SRT framework suggests that (1) polemic representations (in this case, dredging support) originate from intergroup conflicts and power struggles, and (2) that polemic groups (e.g. dredging advocates) will attempt to increase their fortunes by promoting the uptake of their beliefs. There was certainly strong evidence for the latter of these assertions in the transcripts. However, given the widespread nature of dredging support – this did not appear to be a polemic 'minority' - rather a 'majority' belief, amongst flood affected communities.

Building on this, more specifically, there may have been a phenomenon referred to as 'Psychological Reactance' at play. Reactance is defined as anger and attitudes that are exacerbated when individuals perceive their freedom to be restricted, sometimes producing reactant behaviours where individuals attempt to reinstate, or recover, lost freedoms (Brehm, 1966, 2000). So, by becoming an advocate for dredging, one may feel a sense of taking matters into one's own hands, reinstating a sense of freedom, lost to the flood management authorities.

A clear example of reactance appeared to arise in Glenridding. The nature of the flooding in Glenridding was such that floodwaters blocked roads either side of the settlement, meaning that the village was effectively isolated for a short period of time. Emergency services could not access the village, whilst phone lines and Wi-Fi were cut off. In a playing out of a natural experiment of sorts (i.e. "what would happen if the Environment Agency's limitations were removed temporarily?") the villagers called upon local companies with heavy machinery to dredge Glenridding Beck. In the absence of official advice, several diggers were utilised to dredge a portion of the river near to the central village bridge, which reportedly was causing a blockage (McCall et al., 2017):

> *"…**a small company just a few miles away** who had some very large machinery, and **they were very capable**, and **they came along to dredge the beck"** (I1: 2)*

> *"… **the local people, [and the local councillor**] has been extremely helpful, especially **organising the workmen** who came afterwards and **dredged all the beck**." (I4:1)*

This is of course an example of quick thinking and leadership, which may have averted further flooding; and when the EA accessed the village, the dredging was permitted to continue. However, what is revealing is the positivity and pride associated with dredging. This was suggestive of a form of reactance, in which the villagers were able to reassert their sense of freedom:

[6] These articles were published on the 2nd and 13th of January, 2016.

*"Well, **we got more done in three days** of being cut-off **than the Environment Agency have probably have managed in what? Three weeks?"** (I3a: 13)*

*"Yeah, he [the local councillor] **stood up to the powers that be"** (I13a: 14)*

*"…they say we can give you flood defences, we can gives you doors, we can do this- **it proved a point just by digging it all out- did it.** And **whatever was in there, the trout, they've come back, everything will come back**, its nature's way- nature finds a way." (I3a: 6)*

*"**When no one's coming** to you, **you could get on**" (I3b: 13)*

*"And to be perfectly honest, by the time the Environment Agency […] turned up on the Wednesday afternoon – **they basically just said, for the time being**, for the week- for the rest of the week, **just get on with it, we won't interfere - which was really brilliant"** (I3a: 13-14)*

This strongly suggests that the execution of localised dredging was a direct response to the Environment Agency's prior inhibition of freedom and efficacy. This was viewed as a victory of sorts – and through an SRT lens, one might say that the polemic group had persuaded the more powerful, hegemonic group to allow dredging, increasing the polemic group members' agency. This process of reactance as a response to inhibited freedom is represented as a further set of feedback loops in *Figure 3.6.4* below.

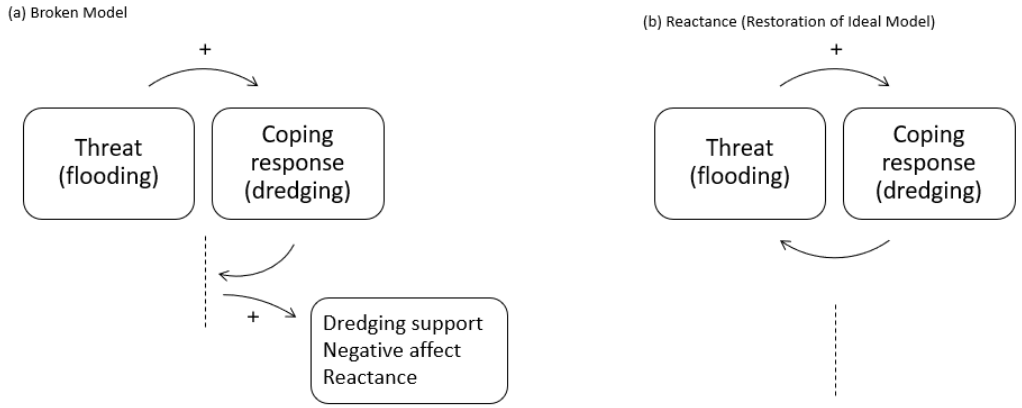


***Figure 3.6:4** - Broken and restored feedback cycles of threat response, related to dredging. This time, (a) is the 'broken model' as dredging activity is being prevented by EA restriction – increasing (+) dredging support, negative affect and reactance. Model (b) illustrates an attempt to restore an ideal model, via reactance, when the external barrier is temporarily displaced. Model (b) here could be described as a 'false ideal model' given that dredging does not necessarily reduce the initial threat of flooding.*

However, whether this truly was an example of reactance or not might be debateable. One criticism of this analysis is that the need for 'efficacy' may have been more salient than the need for 'freedom' (i.e. autonomy). The need for efficacy does not fit neatly into the PRT framework. However, this might be a limitation of PRT itself, as it seems plausible that reactance could also be triggered by threats to other psychological needs, including efficacy, given such

needs enable individuals to cope with threats. Nevertheless, this cannot be fully clarified without further investigation.

Overall, it seems possible that reactance, following a perceived freedom threat, occurred, and that broader calls for dredging may also be exacerbated as a reactance response to the perceived restrictions of the Environment Agency. Understanding such drivers of policy support is significant for adaptation, as in response to sustained public pressure, dredging operations were later announced for several flood hit rivers in Cumbria (Dredging News Online, 2016).

3.6.4 A need for belonging

Another key theme made salient by the flood event concerned a *sense of belonging*, which was tied to a subtheme of *strong place attachments*. Many participants contributed examples of how community groups, volunteers, neighbours, family, friends and colleagues had offered support (forming the subtheme: *positive views of interpersonal and intergroup support).* Participants explained how this played into a feeling of belonging to the local community, and how the floods had stimulated integration, bringing people closer together:

> *…it does make **you realise how nice people are** and […] I mean **we knew our neighbour anyway** obviously but you know, **we've had a bit more contact with her** and erm- that's been nice, and **people locally have been lovely** (I11: 12-13).*
>
> ***Community spirit** yeah, **it wouldn't have worked otherwise** (I3a: 14)*

Interestingly, when discussing the Cumbria floods, participants' sense of belonging had the capacity to override fears about future flooding – a perspective which makes sense in relation to past literature. Interpersonal support has often been discussed as an important coping mechanism in threatening life circumstances (Breakwell, 1986; Lazarus, 2006; Lazarus & Folkman, 1984), and research has also highlighted the importance of interpersonal coping strategies for flood recovery (Butler et al., 2016; Walker-Springett et al., 2017). For instance, such research has reported that over 80% of people felt that community spirit made it easier to cope with the Somerset floods in 2013/14 (Butler et al., 2016: supplementary info, p. 10). What was fascinating however, was that even though participants saw the threat of flooding as remaining (and even likely to increase), participants spoke about their *refusal to move*:

> *…its, the **community spirit**- its- my husband's lived in like [this] area his whole life and when we first looked at houses together he said, **"I don't want to move away from the area, I love this area, everybody's so nice, I feel safe, I feel secure and I feel like I'm part of the community"** and I was like "oh whatever" like thinking "I'll just live wherever cos I really don't care where I live". But **now this has happened they've put us in erm- in a temporary house** [in a different] area and I- the house is beautiful but **I cannot wait to get back down to […] where I've been living […] like even though I know its probably gonna to happen again** its not stopping me from- from wanting to be back down and I think a lot of people are feeling the same because of- like the **help and support and the community spirit** and- you know- like- you're talking to neighbours and helping out neighbours that you didn't even know were there- […] and I think **it helped brought everybody a lot closer together** (I10: 12)*

This is interesting for several reasons. Firstly, it suggests that belonging can also be threatened by floods. This fits with previous research concerning sea level rise in Australia, which has suggested that climate hazards threaten a vast range of socially valued phenomena, including 'belongingness" (Graham et al., 2013). Secondly, it shows how place attachment, and sense of belonging can influence, and potentially obfuscate coping behaviour. This aligns with previous research, which finds that individuals with a strong place attachment are more unwilling to relocate when there are hazards, and are more likely to return afterwards (Bonaiuto et al., 2016)

Yet what is particularly interesting here, was that for this participant quoted, the threat of not belonging to a community *exceeded* the threat of further flooding. In turn, this perhaps could be conceived in novel terms as a *Threat Dilemma* – whereby two threats directly contest one another to influence coping behaviour. Past research investigating the decision making in bushfires and other emergencies, suggests wide ranging reasons for why individuals might choose to stay or leave (Johnson et al., 2012). Such work points to an underestimation of the threat, overestimation of perceived ability to defend properties (i.e. unrealistic efficacy beliefs), discounting of warning signals, and a reluctance to leave, amongst other socio-political and cultural factors. Furthermore, some responses appeared to be gendered, with men more unwilling to leave (Oneill & Handmer, 2012). Similarly to the present analysis, researchers have suggested a potential role of psychological reactance to help explain such responses (Dengate, 2019).

Yet, while decision making in emergency circumstances is clearly complex, to date there is not a general theoretical framework that sufficiently expresses cognitive processing of conflicting *threats* – or, how such conflicts may force individuals to choose a specific path of coping. The past literature is well versed in the idea of moral and ethical dilemmas – in which two moral principles conflict with one another (e.g. Christensen & Gomila, 2012). Research on such dilemmas suggests that personal dilemmas tend to be processed emotionally, while impersonal dilemmas tend to be more reason based (Greene et al., 2001). However, such work does not help to explain when decision making may shift from a preference toward one form of coping versus another (e.g. stay, leave, or protect). Furthermore, in contexts where both hazards and coping options threaten several personal attributes, such as health, safety and psychological needs, the problem at hand is quite distinct.

It thus seems possible that individuals weigh up (perhaps on an automatic level) the threat of coping options against the perceived threat posed by the hazard. When one threat exceeds another, this may be the 'tipping point' for a specific path of action relating to coping and adaptation. In the case of the participant quoted above, going back to the community at risk of flooding, rather than moving to another area was the 'least threatening path'. Similar threat dilemmas have been observable in relation to other flood-risk events. For instance, a small number of residents in Whaley Bridge, UK, refused to leave their home in August 2019, despite the significant risk of dam collapse (BBC News, 2019). Residents who didn't move did not feel the threat was sufficient to warrant displacement – perhaps indicating a subjective tipping point had not been reached. In turn, the concept of threat dilemmas, and tipping points, may usefully extend research on

climate adaptation, given that a complex range of health-related and social threats are posed simultaneously by climate hazards (Graham et al., 2013).

The participant's quote above is additionally interesting as it contradicts some expectations according to existing research. Specifically, it contradicts Maslow's hierarchy of needs model (Maslow, 1943), as it suggests that a higher need (belonging) was viewed as more important than a basic need (safety). Furthermore, the example, and other interviewees response (see quotes above) also adds further complexity to past research on adaptation.

Together, these findings have important policy and communications implications, given that the government has stated not all UK communities can be saved from flooding, and some residents will be forced to move home (Harvey, 2018). For instance, there are already plans being put in place for communities such as Fairbourne in Wales to be decommissioned due to sea level rise (CCC, 2018). If strong place attachments are at play in such adaptation contexts, this is likely to pose a range of threat dilemmas, and a variety of challenges for community members, policy makers and communicators to navigate.

3.6.5 Mixed perceptions of climate change

Generally participants were accommodating of the possibility that climate change could have played a role in the floods:

> *…**it does certainly seem that- that global warming's a contributing factor** and of course that's **not going to go away** that's just **going to get worse** with the way we're going at the moment. Yeah, I feel it could definitely [make flooding worse] yeah. (I9: 6)*

> *[Gasps] [laughs] **As far as I'm concerned, it's a no-brainer**. I just, you know, it's been a bad El Niño year hasn't it—it's been a big El Niño year. **We've really messed this planet up, and it's time we started to realise what we've done.** And it's gonna be too late. I mean **it's just tragic for your generation, I think it's appalling what's happened. Absolutely shocking**. (I5: 10).*

However, there was also denial of climate change:

> *Erm, no, **I don't believe in climate change**. (I1: 4)*

> ***I think it's a load of rubbish** because we have a local paper called the Herald on a Saturday and it goes back 25 years, 50 years, 75 years, a hundred years, **it was happening in 1935.** It – **its just nature, its just the way it is** and its, man having to work with nature. (I3a: 15)… **I'm very sceptical, sorry** […] I just think it - **everybody's more aware now because of the news globally** (I3a: 19).*

Only a few participants noted that climate change could be a driver of flooding, before this was raised as a question in the interview. Instead, most participants considered the main cause of the flood to be *an extreme amount of rainfall*, or one of various *local causes* (e.g. a bridge blocking the river flow, or lack of river maintenance and management). This perhaps suggests that flooding was made sense of in local terms, suggesting a bias in 'construal level' (Trope & Liberman, 2010) towards concrete and proximate, rather than distant and abstract, explanations. This is interesting to consider, given research has reported that individuals perceiving climate change impacts with lower psychological distance

tend to be more concerned (Spence et al., 2012). It is possible that individuals did not feel climate change was geographically, socially or temporally relevant, and thus drew on explanations that were proximate instead.

Irrespective of perceived causation, almost all participants acknowledged that the threat of flooding was likely to increase in the future. Interestingly, this appeared to be true even for participants who denied the existence of climate change, further suggesting how local flooding was typically viewed as conceptually and causally distinct:

> *Erm,* ***exceptional amounts of rainfall*** *[caused it] basically […]* ***I don't believe in climate change*** *[…] I just tend to think that these things happen throughout the history of the world and er- we haven't been here long enough to appreciate what's really been going on throughout history. […] Yeah****, its possible*** *[the floods could get worse in the future].* ***Might not be for a long time, but yeah, its possible.*** *(I1:2 & 4).*

Given the apparent mix of opinions of participants, these results do not necessarily align with research which has found that flood impacted individuals have heightened risk perceptions of climate change (Capstick et al., 2015; Demski et al., 2017). Nevertheless, this was of course a small-scale qualitative study, rather than a quantitative between-groups comparison.

3.6.6 Symbolic Stages in the experience of flooding

A pattern of shared, chronological, behaviours and attitudinal experiences were also apparent in the analysis. These experiences have been organised into a thematic-stage model (See *Figure 3.6.5* below). This paints a clear picture of the sorts of behavioural and attitudinal responses, which occur before, during and after a flood event. Within this model, five symbolic, chronological stages of floods experience have been identified: *Uncertainty*, *Mitigation*, *Adaptation*, *Waiting*, and *Post-Flood Coping*.

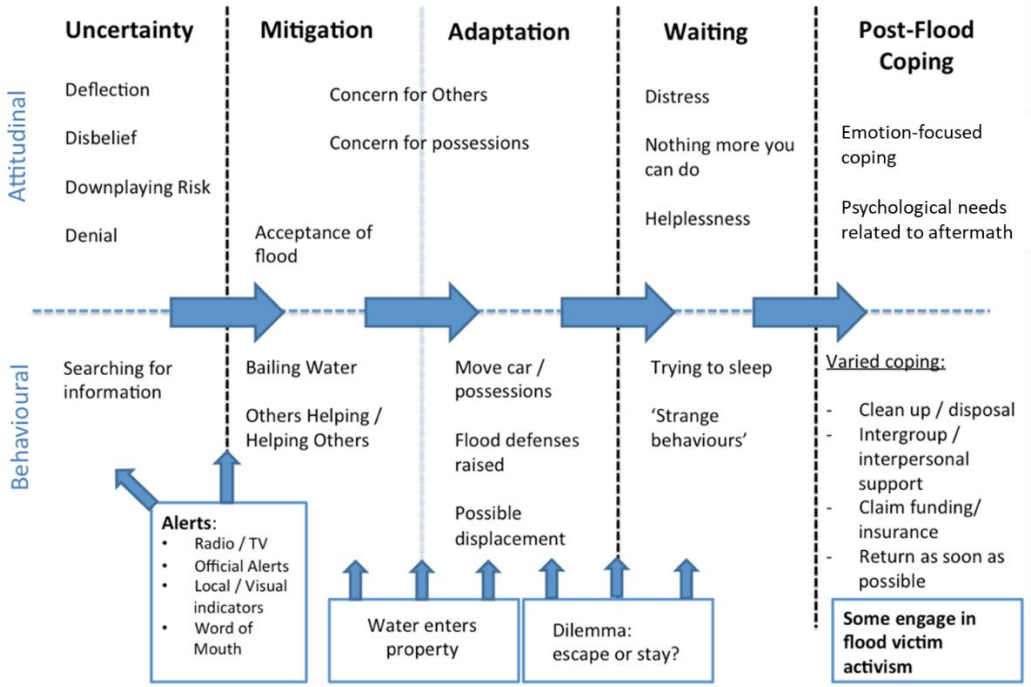


Figure 3.6:5 - Five key psychological stages of the flood experience. The chronology involves attitudinal and behavioural elements, as well as key symbolic events (blue boxes). The mitigation and adaptation phases are somewhat overlapping, and therefore separated with a semi-transparent line.

The *Uncertainty* stage involved searching for information, deflection, disbelief and downplaying of the flood risk:

> *I was like "you are just completely **blowing this whole thing out of proportion**, we'll be fine" (I10:1).*
>
> *…not that I wasn't overly bothered but **I wasn't thinking, you know, that we were gonna be affected at all** (I7: 2)*

At this stage, the threat of flooding was not fully known, though a threshold appeared to be breached when the certainty of flooding became accepted, typically following a communicated warning or cue (alert sources included: TV or Radio broadcasts, Environment Agency warnings, word of mouth, and visual indicators). There was a disparity of experiences of warnings, suggesting communications could be improved to more effectively alert residents about imminent flood risks:

> *…on the Saturday **I was aware cos as we looked from here across the lake** err- **you can see how the water comes off** in various, erm, **various little streams** and there was **more than normal**, so, that was **a good indication** (I1: 2)*
>
> *…**we got a warning** err sometime in the evening to say that they were possible, but we get that about once a month (I12: 1)*
>
> *…**nobody give us a warning, there wasn't a warning [...] what do you mean by a warning?** Nobody came round and warned us, **I don't know how they could warn us** (I4: 2)*

> *…about half an hour later **my mother in law […] rang** and she lives on the same street as us, three doors away, she was like, **"you need to come home now"** (I10: 1)*

In the *Mitigation* phase, mitigation activities are conducted to reduce the amount of flooding damage.[7] Behaviours included bailing water, and neighbours helping each other minimise risk. Participants often noted beliefs about the efficacy of these behaviours:

> *…so there's all these people coming to help to try and **bucket this water away** from the front of our house, and it **felt at one point like it was working**, and it clearly wasn't (I11: 1)*

> *…so we was **scooping like mad trying to get that water away**, so it got to a point where we though **"this is pointless"** because its not- **its not going down**, its just coming back up again (I3b: 1).*

During the mitigation phase, a symbolic threshold noted, was the point at which floodwaters entered a residence:

> *…he just stood at the door cos erm she was kind of just half dozing and he just kind of looked at me and he went, **he kind of mouthed, "it's come in".** And that was a funny feeling you know. Cos I think right through the night **I'd kind of replayed to myself** what will I feel like, **what will I feel like if it happens?** (P7: 5)*

This moment typically symbolised a shift towards an *Adaptation* phase, where behaviour is aimed at reducing damage rather than mitigating the flood itself. This phase was characterised by moving possessions to reduce the impact (e.g. valuables, furniture), or sacrificing an area (e.g. abandoning the ground floor). Often at the end of this phase was a dilemma about whether to escape, stay or become trapped in the area. This could also be viewed as a threat dilemma (as discussed earlier). Thus, another sub-theme here was having to negotiate the emotional challenge of potential displacement.

However, it must be noted that the mitigation and adaptation phases were somewhat overlapping, and entry of floodwaters occurred at different points for different participants. During both the mitigation and adaptation phase, an overarching concern for loved ones (family members, friends, neighbours etc.) and animals (pets and livestock) was also salient:

> *So at that point **I said don't do anything silly** and he said "I'm already doing something silly**, I'm out here in the pitch black I don't know where I'm putting my feet**, and, I'm up to my waist in water". **So the next few minutes were pretty distressing** I have to say just waiting and talking to him as he was making his way across [the field] (I8: 1).*

> *So **we were frightened of the horses**, you know, **what we were going to find next morning**, because we were sure they would have drowned (I12: 5)*

[7] Note: mitigation used in this context does not refer to climate change mitigation.

Once floodwaters had entered, a very common experience was *Waiting.* This stage was characterised by stress, attempts to sleep or inability of sleep, and interestingly what participants termed 'strange behaviours'. For instance:

> *It's just* ***a waiting game*** *(I7: 3)*
>
> *…we just went upstairs and watched out of our- our front window […]* ***just watched it go by – tried to sleep but you can't really****- couldn't really sleep through- through that (I3b: 2)*
>
> ***…[I] remember doing something stupid*** *like wrapping, thought we'd* ***wrap some Christmas presents*** *(I7: 2)*

This phase was characterised by a relative increase in emotion-focussed coping, as problem-focused coping strategies were made largely impossible, whilst the floodwaters remained.

Once the floods receded, a final phase of *Post-Flood Coping* was initiated. This involved a vast range of coping behaviours (e.g. cleaning up, disposal of items, applying for funding, insurance claims, returning to the impact site). Many participants noted experiences of intergroup and interpersonal support. This included community groups, friends and neighbours providing food, cleaning equipment and replacements items (such as those mentioned in relation to the theme of 'belonging', earlier).

Previous research has highlighted that literature about flood recovery is much more limited than that of preparedness and emergency response; and that existing framings of flood recovery are often too simplistic (Medd et al., 2015). This 'stages of experience model' therefore adds some useful contributions in this space. The model shares some commonalities with past longitudinal research with flood victims, which plotted varied experiences of flood recovery over time, demonstrating a distinct series of 'highs' and 'lows' during flood recovery (Medd et al., 2015; Whittle et al., 2010). Fitting with the findings above, this work suggests that the challenge of flood recovery is often compounded by secondary stressors produced when flood victims engage with agencies related to flood recovery. This longitudinal work however did not seek to express common stages of socio-cognitive experience, as is presented here.

The stages model above also has similarities with other frameworks too, most notably the *Disaster Management Cycle* (DMC - e.g. Coetzee & Van Niekerk, 2012; Rushford & Thomas, 2015; Tingsanchali, 2012).[8] The DMC model suggests three broad phases of disaster response with sub-components, which fit together cyclically. These are *pre-disaster: risk reduction* (i.e. mitigation and preparedness), *post-disaster: emergency response* (i.e. individual responses and broader response/relief) and then *post-disaster: recovery* (i.e. rehabilitation and reconstruction). However, while individual level responses are noted in the emergency response aspect of the DMC, the model obfuscates these with collective and policy level responses overall – so detail about typical individual experiences is largely absent. By focussing on the individual level throughout, the new 'stages of experience model' adds novelty (a) by specifying common attitudes and behaviours, (b) adding original stages such as 'adaptation' and

[8] See also here for a further adaptation of the DMC to flooding: http://www.sehinc.com/news/4-steps-effective-flood-management-plan

'waiting', and (c) directing greater attention to psychological experiences – which have clear importance for wellbeing outcomes (e.g. Waite et al., 2017; Walker-Springett et al., 2017). Furthermore, (d) by detailing common thresholds that act as 'watershed moments' between phases of responses, the model is a useful tool for supporting individuals on the ground by allowing key stages to be identified more easily. This means appropriate interventions, communications and assistance can be tailored as a hazard event unfolds.

3.6.7 Model selection

The key themes in this chapter can be explained and interpreted in relation to a range of existing theoretical frameworks. As noted earlier, some of the conflict between state and individual actors around dredging could be interpreted via Social Representation Theory (SRT), but this was only insightful at a broad level. In greater depth, the results appear to make sense when explained through Breakwell's (1986) Identity Process Theory (IPT), which has been applied in partnership with SRT to explain climate relevant behaviour (Jaspal et al., 2013). It is possible to consider that participants experienced the flooding event and related management as a multifaceted 'identity threat'. As noted in the literature review, an identity threat is experienced when an internal or external phenomenon is perceived to be threating and cannot straightforwardly be assimilated or accommodated into one's identity structure. Specifically, an identity threat is suggested to occur when there is conflict with one or more identity guiding principles – a set of desirable 'end states' for identity. These principles are self-esteem, continuity, distinctiveness, self-efficacy, (and extensions of the theory add) belonging, sense of purpose/importance/meaning, and compatibility between elements of identity. Given the range of threats posed toward self-efficacy and belonging, it could be interpreted that participants were experiencing a set of identity threats posed by the flood event. IPT explains that coping strategies are adopted by individuals to mitigate and eventually eliminate the threat – explaining why dredging support and interpersonal coping manifested so noticeably, and perhaps also why a sense of belonging can even increase following a flood event. The theory also notes individuals may persist with a sub-optimal coping strategy, as long as the threat conditions remain, suggesting why there was ongoing support for dredging.

However, there are issues with applying this theory to the findings. A key issue is whether or not threats to self-efficacy truly comprised an 'identity threat', or, another kind of threat. While Jaspal et al (2013) note that IPT helps explain circumstances where enforced change and behavioural requests interfere with one's daily life, in the context of flooding, the threat to efficacy seemed to be less of an identity problem, and more of a pragmatic issue related to coping. While the threat to 'belonging' was more clearly related to one's identity as a member of a specific community (e.g. perceiving oneself as 'a local villager'), participants did not appear to need self-efficacy to advance their identity or group memberships. Instead, it was more that the flooding affected their basic sense of safety, and the normality of everyday life. Self-efficacy was what participants needed to get life back to normal, what they needed to deal with the floodwaters, and to minimise future environmental hazards, not to salvage their identity.

Given the self-efficacy threat here seemed to be a pragmatic issue related to effective coping responses, we might look to other theory to help explain the findings. Protection Motivation Theory (PMT - Maddux & Rogers, 1983; Rogers,

1975) appears to be a particularly well suited framework for interpreting this finding, and other aspects of the analysis. As noted in the literature review, the PMT framework explains that protective actions are motivated by a dual process, comprising of a *threat appraisal* (i.e. perceived vulnerability, and feeling the risk is severe), and *coping appraisal* (i.e. self-efficacy and response efficacy). The theory helps to explain why the flood victims needed self-efficacy – as this is an important precondition for a coping response. It helps to suggest why there was anger in response to efficacy being inhibited by the EA's flood management – as PMT suggests that negative affect (i.e. anger and fear) occurs particularly when there is a threat without sufficient efficacy to cope. The theory also suggests that adaptive coping behaviour is less likely to occur when threats are overwhelming, and efficacy is limited. This helps to explain why individuals felt a sense of hopelessness, and 'nothing more that could be done' once floodwaters entered their home. Furthermore, the theory helps to explain dredging support, as it suggests coping strategies are made more likely when associated with heightened response efficacy (i.e. believing it will be effective) and self-efficacy (i.e. feeling you can do something about it personally). PMT might also help to explain why individuals didn't feel the need to move away from flood-prone areas – as their appraisal of the threat of flooding was not viewed as having sufficient severity to warrant such a response.

However, PMT is less well suited to explaining the roles of belonging and place attachment, and the potential role of reactance, given these are not aspects of the theory. Reactance as a coping response, for instance, may be better explained as a response to a freedom threat, as suggested by Psychological Reactance Theory (PRT). Furthermore, while Protection Motivation Theory is applicable, it does little to explain how external factors, such as the actions of the authorities, can have causal relationships with cognitive factors, - for instance, how the EA's engagement led to reduced efficacy.

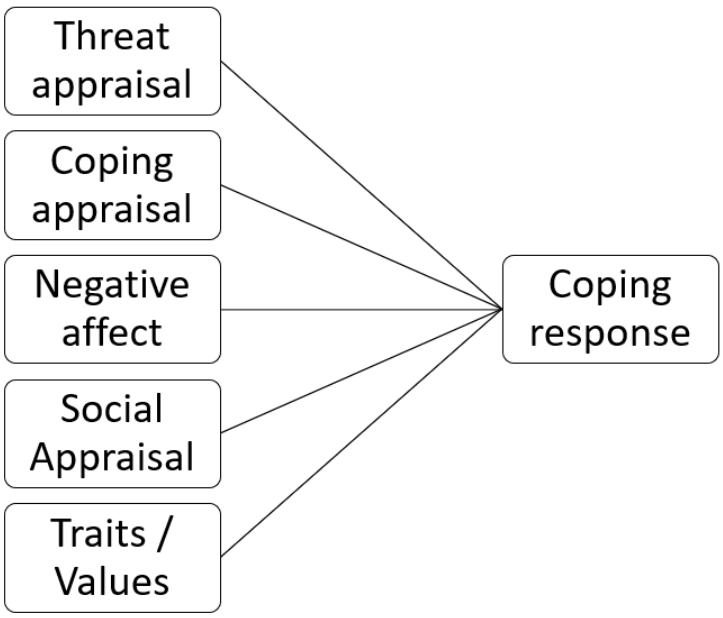


Figure 3.6:6 *- A theoretical extension of the PMT model expressing a possible direct relationship between several independent variables and a coping response (e.g. support for policy, flood activism, or climate action and so on)*

Overall, given the findings here and the salient factors uncovered in the literature review, it makes sense to use PMT as the starting point for further work in this thesis. Nevertheless, given the original model does not incorporate several factors identified as salient in this chapter, or in the literature review, the model could be extended further. For instance, it would be beneficial to test the roles of collective efficacy, reactance, trust and social norms, alongside the core threat and coping factors of PMT. A suggestion for how PMT could be extended by incorporating evidence from this chapter, and the previous literature, is expressed in *Figure 3.6.6*. The predictors detailed in this hypothetical model extends those included in PMT (threat appraisal, coping appraisal and negative affect) through the addition of social appraisals (e.g. trust, social norms, freedom threat) and traits/values (e.g. political views, basic values). Extending the theory in this way could be invaluable, helping to identify which factors are most influential, relative to one another. This, in turn, would help communicators and policy makers to more accurately design interventions to encourage adaptive responses. Such quantitative testing will therefore form the basis of the next chapter.

3.7 Conclusion: Implications and future research

This chapter has built on the literature review, by identifying a range of salient socio-cognitive themes related to public experiences of a major flood event in the UK. In particular, the findings highlight the importance of perceived self-efficacy in relation to coping behaviours, though the findings also suggest collective-efficacy, response-efficacy, and the need for belonging can also play roles in promoting problem-focused coping behaviours. Importantly, the study also highlights that these psychological needs can be threatened by both the flooding itself and by engagement from authorities who are responsible for managing flood risks. In addition, the findings suggested the concepts of 'threat dilemmas' and 'tipping points' to explain decision making when there are both threats posed by hazards and coping responses. The study also contributed a novel model unpicking common stages of experience, which could be used to help understand experiences before, during and after flood events, and pinpoint flood management interventions.

This analysis also raises a set of interesting broader questions and challenges for communications researchers and practitioners, that still need to be addressed: Which forms of efficacy are generally most influential for facilitating adaptation behaviours and policy support? How can communications nurture efficacy beliefs most effectively? How can collaborative engagement activities navigate potential tensions between stakeholders and experts – sometimes referred to as 'local knowledge controversies' (Whatmore, 2009; Whatmore et al., 2008)? If dredging is supported by a majority, does its majority status by nature make it harder to challenge? Answering such questions could help to further enhance the design of adaptation-focused communications.

Overall, these findings highlight the clear importance of conducting research with people that have lived experience of hazards that are expected to worsen due to climate change. Such research can help to close a feedback loop between the public and practitioners, by incorporating experiential knowledge into the development of communications and policies – so that interventions work with, rather than counter to people's psychological needs.

3.7.1 Strengths and limitations

Given this was non-longitudinal, non-experimental research, causality between elements cannot be ascertained (Bryman, 2012). Given the relatively small number of participants in this study, generalisations should also be cautioned against (Bryman, 2012). Interview questions were also limited in that they made no direct reference to communications and engagement, and so, insights about engagement were inferred from responses to other questions.

Despite these limitations, this research has provided a range of interesting and novel contributions. The study has helped to contextualise this research project in relation to real world events, while offering invaluable insights ahead of further chapters. The aims of this study were for it to be exploratory, with high ecological validity, to provide initial insights that can be investigated further – especially through quantitative work (Bryman, 2006). The qualitative methodology gave rich data, via in-depth interviews, while allowing flexibility to travel to the study locations at short notice.

Furthermore, the questions were broad and unbiased enough that salient issues emerged on the terms of the participant. This was perhaps preferable to imposing the importance of communications and engagement onto the interviews, in a 'top down' fashion. The fact that a range of issues related to public engagement arose without prompts has added weight to the rationale of focussing this thesis work on the role of communications in promoting adaptation.

3.7.2 Key implications for climate change communication

The insights presented in this chapter build on existing best practice guidance about the need to empower flood victims, and remain sensitive while communicating flood risks in a changing climate (e.g. Messling et al., 2015). The present work suggests that very careful attention should be given to the possibility that engagement can undermine specific psychological needs, such as efficacy and belonging. In particular, if communications undermine the flood victims' needs for efficacy, then they seem likely to backfire, potentially inducing maladaptive responses. It is possible negative responses can include reactance (whereby individual act counter to recommendations).

Practically, communicators, including the EA, are likely to benefit from developing communications practices that increase flood victims perceived efficacy to cope with future flood risks. This might involve reframing information to nurture self-efficacy. Or, it may involve greater use of collaborative engagement approaches, like co-production, to increase community inclusion in policy design and flood management (See *Chapter 8* for a discussion of such approaches). Communicators aiming to provide information during hazard events may benefit from reflecting on the social-psychological stages of flooding (presented above), to help ensure interventions are targeted effectively.

3.7.3 Next steps

There are many ways this research can be taken further. For instance, follow up work could test ideas related to the stages of experience, or 'threat dilemmas' and 'tipping points', to see if these concepts can be generalised to other hazards, such as wildfires, or drought. Alternatively, research could take a broader view of adaptation and communications – to identify whether individuals in the UK understand what is meant by the term 'adaptation', and to see how flooding may

or may not be linked to climate change adaptation in the public mind, building on ‘attribution’ research (such as: Ogunbode et al., 2018).

However, to fulfil the aims of this thesis, the most crucial questions concern the relative influences of factors, such as threat appraisals, efficacy and reactance, in facilitating adaptation behaviours. The findings in this study cannot conclusively provide judgements of the relative importance of specific factors for behaviours like supporting dredging or improving household flood protection. While several forms of efficacy (self, collective, response etc.) and sense of belonging appeared to be related to preferences for coping responses, further research is needed to ascertain their relative importance for promoting action. While PMT appears well suited to explain why adaptation relevant action occurs, it was noted that this model should be tested and built on further. The next chapter will commence attempts to do this, by using a follow up survey to test a PMT model extended with several factors found to be salient in this qualitative work and in the literature review.

Chapter 4

An online survey exploring the psychological dimensions of adaptive actions and policy support related to UK flooding

Image: “Tewksbury flooding” © Ian Berry, reproduced with permission via Climate Visuals

4.1 Abstract

The previous chapter established several key qualitative themes associated with residents' experiences of a severe flooding event in Cumbria. These inductive themes shed light on the importance of flood victims' sense of efficacy, belonging, reactance and support for dredging in the aftermath of flooding. However, questions remain around the most influential factors underpinning policy support and behavioral willingness in relation to floods adaptation. To build on the previous chapter, assessment is needed to address which forms of efficacy (e.g. self, response, and collective efficacy) and which other factors, are most salient. In this chapter, an online survey with flood affected and non-flood affected members of the UK public (N=279) is analyzed to further explore the ideas generated in the previous qualitative work. Modelling shows that self-efficacy was influential for *personal-level* threat responses; response-efficacy for *policy-level* responses; and collective-efficacy for *social-level* climate change responses. Together an extended version of Protection Motivation Theory (PMT) was found to be highly explanatory for predicting responses related to adaptation. While personal experience was non-significant, there were significant differences between flood affected respondents and non-flood affected respondents on several outcomes, including dredging support, trust, and anger. These findings are discussed in relation to relevant literature and the practice of communicating adaptation. Key questions are identified for further analysis in subsequent chapters.

Highlights

- Efficacy variables were found to consistently influence behavioural intentions and policy support in relation to flooding, outweighing the influence of other threat and social appraisal factors.

- Self-efficacy was particularly influential for personal-level responses to direct, proximate threats; response efficacy for policy-level responses; and collective efficacy for responses requiring broader social change.

- Flood victims were found to have significantly higher support for dredging, local place attachment, negative affect (anger), and lower trust in government than non-flood affected participants; but there were no differences in climate change concern.

4.2 Introduction

This chapter sets out to further investigate some of the key themes and questions that emerged from interviews with flood affected residents in Cumbria, presented in the previous chapter. Qualitative interview analysis in *Chapter 3* uncovered several key themes, including: *strong needs for efficacy*, *support for dredging*, *a need for belonging* and *mixed perceptions about climate change.* This chapter aims to explore these themes further, to see if the previous chapter's findings are supported through quantitative work. This chapter aims to add further depth of understanding where qualitative work could not be conclusive, for instance, by testing the relative influence of specific factors on behavioural and policy responses (e.g. support for dredging and climate measures) and testing for significant differences between flood victims and non-affected members of the public in terms of threat and coping appraisals. The chapter also aims to test some factors raised in the literature review (e.g. the role of values in relation to adaptation). Specifically, the chapter will address the following aims:

1) **Attempt to explain support for policy and behavioural responses using an extended Protection Motivation Theory model.** Given Protection Motivation Theory was found to be a useful (but limited) framework for interpreting the themes in *Chapter 3*, this chapter aims to test an extended model in relation to behavioural intentions and policy support. This model was proposed at the end of *Chapter 3* (see also *Figure 4.6.1* below).

2) **Explore the perceptions of flood victims and the general public related to flooding and climate change responses.** Flood victims' beliefs about behaviours; policies; threat, coping and social appraisals; belonging; and climate change will be explored. The study will assess whether themes emerging in the previous chapter were associated with direct experience, or not. Tests will thus be carried out to assess attitudinal differences between flood victims and non-flood affected survey respondents.

To explore perceptions of policies and behavioural responses, this chapter will address several types of responses. Behavioural responses include household level flood protection, flood action group participation, low carbon lifestyles, and climate activism. Perceptions of policies include dredging, hard engineering, and natural flood management (NFM). These responses were mentioned by interviewees in the previous chapter or were deemed relevant to the thesis scope.

4.3 Research questions

The key research questions for exploration in this chapter are:

1. **Understanding experiences and appraisals of flooding**: Do descriptive statistics support findings in the previous chapter, for instance, around support for dredging, and experiences of flooding? Are there differences between flood affected and non-flood affected participants in terms of threat, social and coping appraisals (e.g. climate change concern, support for dredging, trust in government and sense of belonging)?

2. **Predicting behavioural responses and policy support:** Is an extended Protection Motivation Theory model explanatory in this context? Which factors are most influential for adaptation relevant behaviours and policy support? Which forms of efficacy (e.g. *self*, *response*, *collective*, *political*) have the most substantial influence on individuals support for policies and behaviours related to flooding and climate change?

4.3.1 Hypotheses

To test insights emerging from the previous chapter and literature review, in terms of factors relationships to policy support and behavioural responses it is predicted that:

H1: (a) Policy support and behavioral willingness related to flooding will be significantly predicted by an extended Protection Motivation Theory model incorporating threat, coping, and social appraisals, negative affect and traits/values (b) self-efficacy will be more influential than response efficacy, and collective efficacy.

Although values were not a particularly salient theme in the previous chapter, they may play a role in relation to response appraisals. Given some flood victims in Cumbria felt angry that dredging was restricted to protect wildlife, perhaps pro-environmental (i.e. universalism) values are negatively associated with dredging support. It is also plausible that support for natural solutions and climate actions in response to flood risks, will be positively associated with pro-environmental values. Therefore, it is also predicted that:

H2: (a) Support for natural flood management and (b) climate change actions will be significantly positively associated with universalism values, while (c) hard engineering and dredging will be negatively associated with universalism values.

Following findings in the previous chapter, in terms of potential differences between flood victims and non-affected participants it is predicted that:

H3: (a) Flood victims will express significantly different perceptions related to (a) responses to flooding (b) a range of threat, coping and social appraisal factors, and (c) belonging. However (d) there will not be any differences in perceptions, behavioural intentions or policy support explicitly addressing climate change.

4.4 Methods

An online survey was carried out with members of the public in the UK (N=279), to explore perceptions of flooding and climate change, policy support, willingness to take actions, and their relationships with social-psychological factors.

4.4.1 Ethical approval

Ethical approval for this study was granted by the University of Bath (UoB) Psychology Ethics Committee (Ref:16-323), adhering to British Psychological Society (BPS) and UoB ethics and data handling guidance. Ahead of the survey participants were asked to read over a clear information sheet, then gave full consent to take part. At the end of the survey, a debriefing sheet provided further details of the study, and an opportunity to request the study findings once written up.

4.4.2 Recruitment

Participants were invited to take part in the online survey, through website advertisements, news media, and social media posts. For the general public, advertisements were placed on *Call For Participants* (callforparticipants.com), and via the UoB's Psychology community recruitment panel. To encourage flood-affected participants to participate, Environment Agency historic flood maps,[1] news entries about UK floods, and lists of flood action groups were used to identify recent and historic flood locations. Direct emails, and social media posts with recruitment information were sent to organisations and public groups in flood affected areas, or with topic relevance. These included flood action groups, environmental groups, local parish councils, and community groups (such as parish churches). A prize draw for a £50 voucher was offered as an incentive to participants.

4.4.3 Participants

Of the total participants recruited and fully completing the survey (N=274), just over a quarter had personal experience (27.7%, n=76) where floodwater had affected their property, or local area. Just under three quarters did not have personal experience of a flood event (72.3%, n=198). The key characteristics of the sample are illustrated in *Table 4.4.1* below, with breakdowns of responses for the overall sample, and for 'flood victim' and 'non-flood affected' subgroups.

Table 4.4:1 *- Key descriptive characteristics of the sample*

	Overall	**Flood Victims**	**Non-flood affected**
No. of participants	274	76 (27.7%)	198 (72.3%)
Age group	18-24 (27.4%) 25-34 (27.4%) 35-44 (10.9%) 45-54 (10.9%) 55-64 (15.0%) 65-74 (7.3%) 75-79 (1.1%).	18-24 (13.2%) 25-34 (14.5%) 35-44 (7.9%) 45-54 (11.8%) 55-64 (27.6%) 65-74 (21.1%) 75-79 (3.9%).	18-24 (32.8%) 25-34 (32.3%) 35-44 (12.1%) 45-54 (10.6%) 55-64 (10.1%) 65-74 (2.0%) 75-79 (0%).
Mean age group (coding 1= 18-24, 7= 75-79)	M= 2.85 (SD= 1.70)	M= 4.05 (SD= 1.83)	M= 2.39 (SD= 1.40)
Gender	Female (68.6%) Male (30.3%) Not listed (0.4%) Prefer not to answer (0.7%)	Female (52.6%) Male (46.1%) Prefer not to answer (1.3%)	Female (74.7%) Male (24.2%) Not listed (0.5%) Prefer not to answer (0.5%)
Political views (1=very liberal, 7= very conservative)	M= 3.00 (SD= 1.37)	M= 3.58 (SD= 1.32)	M= 2.75 (SD= 1.32)
Universalism (9-point scale)	M= 7.04 (SD= 1.85)	M= 6.58 (SD= 2.05)	M= 7.23 (SD= 1.72)

Note: All percentages reported are 'valid percent', excluding missing data, and thus may not sum to 100%.

[1] https://data.gov.uk/search?q=flood+maps

There were some notable differences between the flood affected and non-affected participants on some measures. Mean universalism scores were .656 (SE= .268) higher amongst the non-affected participants, and this was significantly different t(121.017)= 2.449, *p= .016.* Mean political worldview scores indicated the flood victims were .825 (*SE*= .180) more conservative, again a significant difference t(140.099)= -4.584, *p <.001.* Average age was 1.664 (SE=.233) years higher amongst flood victims and this again was significantly different, t(110.360)= -7.153, *p <.001.*[2] This suggests comparisons between the groups should be treated with a degree of caution, as any perceptual differences could be associated with differing worldviews and values.

4.4.3.1 Further information about the flood affected respondents

Of those who identified as having been affected by flooding (n=76), the vast majority of participants said they had primarily been affected by flooding whilst living in the UK (91.7%). In terms of the number of flood events directly experienced, the most common response was one flood (22.5%), followed by three floods (21.1%). 85.9% of respondents were affected by five floods or less, and 94.4% affected by 10 floods or less. The average number of floods that participants reported being affected by was 4.35 (*SD*=5.39). The mean and standard deviation here is likely to have been skewed by a few high responses where participants reported being affected by '15' '25' or '30' floods.

In terms of time since being affected by a flood, 41% reported being last affected in 2015/16 (the period when Cumbria, Yorkshire and other northern counties were flooded), 19% report being last affected in 2013/14 (the period when Somerset were particularly affected). About 16% reported being affected in 2017/18, and 25% reported last being affected in a year pre-2013, with 9% of all flood affected respondents noted they were last affected by flooding during 2007 (*Figure 4.4.1*).

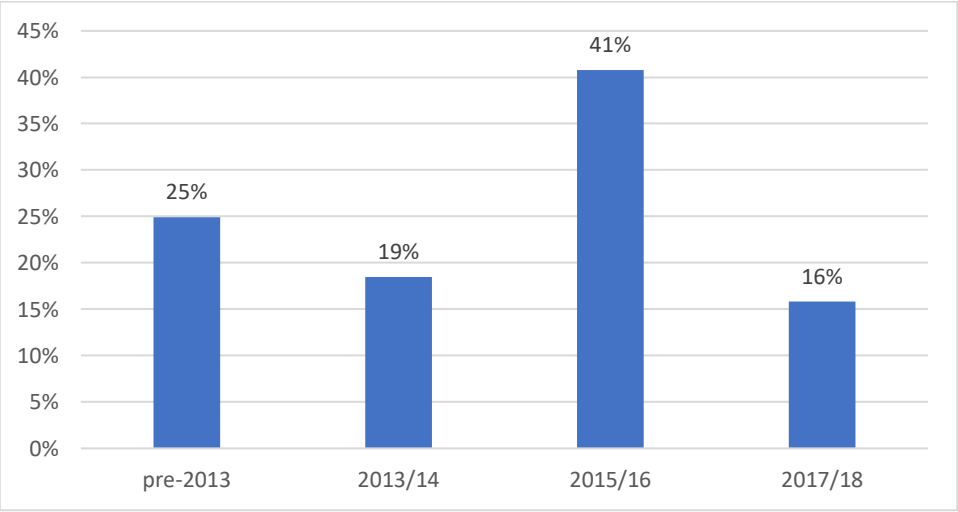


Figure 4.4:1 *- Period in which participants were last affected by a flood (n=76)*

[2] Welch T-test scores were interpreted here given the uneven group sizes, as recommended by Howell (2010), and to provide consistency with t-tests conducted later in this chapter.

The highest proportion of the flood affected respondents were impacted in Cumbria (34.7%), followed by Somerset (10.7%) and West Yorkshire (10.7). This reflects efforts made to recruit Cumbrian participants, following the work in the previous chapter, as well as efforts to recruit people in other regions significantly affected in the 2015/16 (e.g. Yorkshire) and 2013/14 floods (e.g. Somerset). See *Figure 4.4.2* below for a regional breakdown.

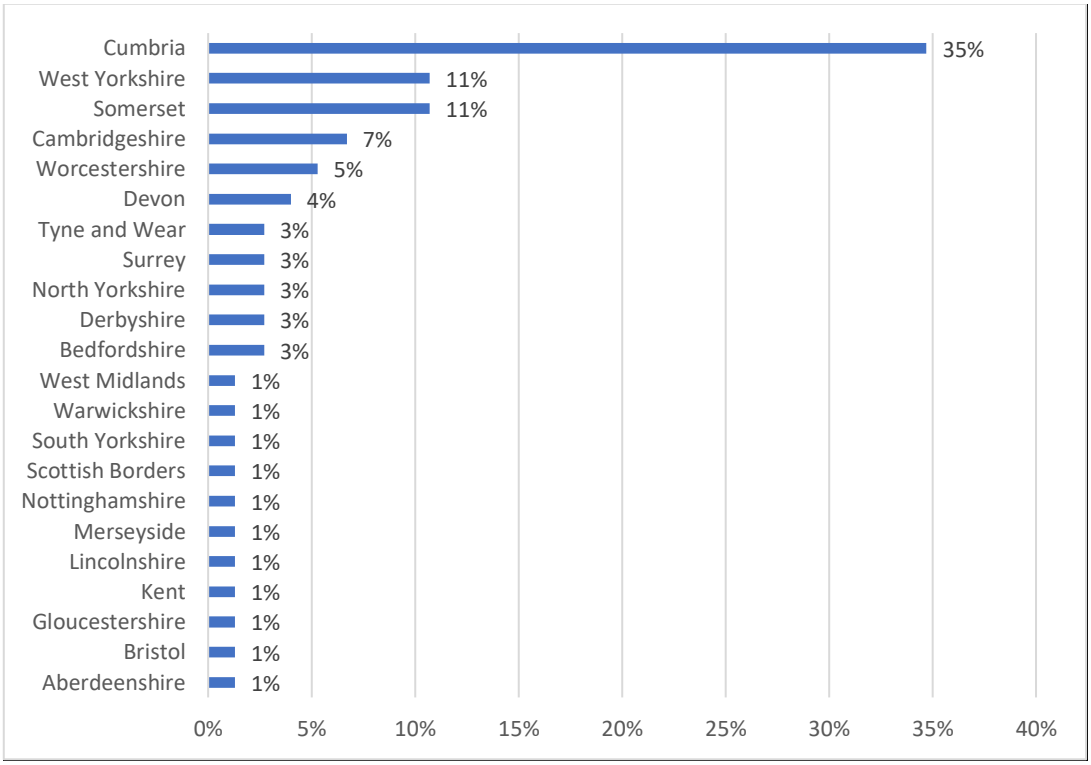


Figure 4.4:2 *- Region where participants report being last affected by a flood in the UK (n=75)*

Most of the flood victims said the last type of flooding they were predominantly affected by was fluvial (i.e. river) flooding (67.1%), followed by surface water flooding (18.4%). Smaller numbers said it was groundwater flooding (5.3%) sewer flooding (5.3%), or, dam or reservoir failure (2.6%). Only 1.3% of the sample were predominantly affected by coastal flooding. This information is shown in *Figure 4.4.3* below. In terms of the directness of impact on those affected, 72.4% said their current or previous property had been affected, and 90.8% reported that others in their local area were also affected by flooding.

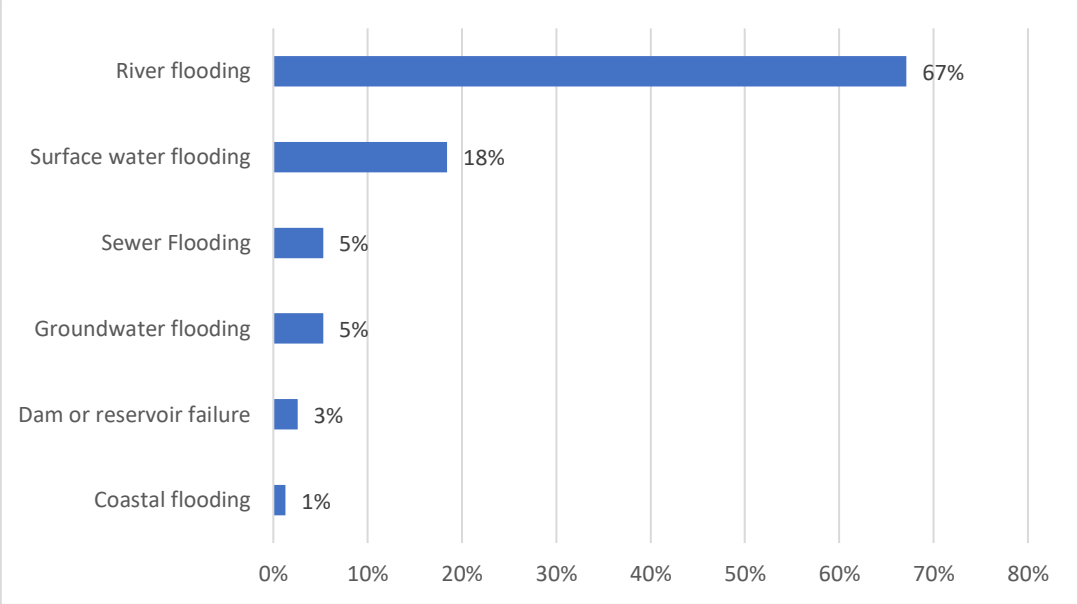


Figure 4.4:3 - The predominant type of flood that respondents were last affected by (n=76)

4.4.4 Procedure

After being invited to the survey, reading through an information sheet, and providing consent, participants began responding to survey questions. Demographic questions (age, gender) were followed by checks of flood experience. Participants were then presented with information that they would be asked to read some proposals relating to flooding and climate change, and then answer some questions. The following section provides details of the materials.

4.4.5 Materials

Nine 'proposals' about responses to flooding and climate change were presented to participants, followed by quantitative measures. A set of five policy proposals, presented in a random order, were first shown to participants. These were: Dredging, Hard Engineering (Rivers), Hard Engineering (Coastal), Natural Flood Management (Rivers) and Natural Flood Management (Coastal). These were followed by four behavioural proposals: Property Level Flood Protection, Climate Change Mitigation Behaviours, Community Flood Action and Climate Activism. Text for each of the proposals was designed to follow a consistent structure with three components: (a) a title (b) a one sentence definition of the proposed measure and (c) a short description of the activity. Several technical and policy resources were used to produce these simple vignettes – ensuring the descriptions were accurate and up to date, but also comprehensible to a non-technical audience (see: CIWEM, 2014; Environment Agency, 2009; Weaver, 2014; Wentworth, 2011). Words with positive and negative valence, and words relating to the potential effectiveness of the proposed measures were excluded from the descriptions, to avoid biasing participant support for the responses. The proposals can be found in the thesis appendix.

4.4.6 Measures

The survey included several measures to assess individuals responses (i.e. intentions for policy support and behaviours related to the proposals), and several predictor variables under headings of flood experience, threat appraisal, coping appraisal, negative affect, social appraisal, and values/traits. These are detailed in *Table 4.4.2* below.

Table 4.4:2 *- Survey measures*

Category	Construct	Details/Items	Sourced/Adapted from:
Response	Policy support*	To what extent do you support or oppose this proposal? Measured on a 4-point scale (1= Strongly support, 4= Strongly oppose)	Leiserowitz (2006)
	Behavioural Intention**	In the next 12 months, how likely or unlikely is it that you will carry out these actions yourself? Measured on a 7-point scale (1= Very likely, 7= Very Unlikely)	Feldman & Hart (2016)
Experience	Flood experience Y/N	Have you been personally disrupted by flooding since January 2013? By disrupted, we mean either floodwater has affected your property, or floods have caused disruption to the area within a 15-20minute walk from your home. [Yes - I have been disrupted by flooding either in January 2013, or after this date / I have only been affected by flooding before January 2013 / No - I have never been affected by flooding]	Capstick et al. (2015)
	Convinced of flood***	"I became certain I would be flooded when....” 6 x choices [I heard reports on the radio / TV / I received an official warning (please provide details) / I saw the floodwaters with my own eyes / Only when the flood water had entered my property / Someone I knew warned me about the flood risk (i.e. word of mouth) / Other (please give details)]	New measure
	Waiting***	“I recall a distinct period of ‘waiting’ once the floodwaters once the flood water had entered my property (i.e. a period of 'inaction', or 'delaying action')” 3x choices [Yes / No / Unsure or Don’t Know]	New measure
Threat appraisal	Personal risk	1x item: "In the next 2 years, my current home/property is at risk of being flooded from river, coastal, groundwater or surface water flooding" (1= Strongly disagree, 7= Strongly agree)	Informed by Capstick et al. (2015), Reynaud et al., (2013) and key UK flooding types (Environment Agency, 2009)
	Climate change concern	How concerned, if at all, are you about climate change, which is sometimes referred to as ‘global warning? 5 x choices (1 Not at all concerned, 2= Not very concerned, 3= Fairly concerned 4= Very concerned, 5= Don’t know/not sure).	Capstick et al. (2015)
	Climate change causation	Which, if any, of the following best describes your opinion about the causes of climate change? 7 x choices: It is entirely caused by natural processes / It is mainly caused by natural processes / It is partly caused by natural processes and partly caused by human activity / It is mainly caused by human activity / It is entirely caused by human activity / There is no such thing as climate change / Don’t know.	Capstick et al. (2015)

Coping appraisal	Self-efficacy	1 x item: Personally, I feel able to take action to support this proposal and make sure it is implemented / Personally, I feel able to carry out this action. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree).	Hart & Feldman (2016a)
	Response Efficacy	2 x items: I think this would be effective in reducing the negative impacts of flooding / This would be effective in reducing disruption and damage caused from floods. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	Hart & Feldman (2016b)
	Collective-efficacy	1 x item: Together, as a collective group, we are able to take action to support this proposal and make sure it is implemented / Together, as a collective group, we are able to carry out this action. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree).	Adapted from self-efficacy measure in Hart & Feldman (2016a)
	Coping self-efficacy	"Think about important matters related to dealing with flooding. For each of the following situations, rate how confident you are that you can successfully deal with them". 10x items (Maintaining personal security – protecting yourself and your property / Going back to normal routine – grocery shopping, banking, gas/petrol stations, work, etc.) Measured on a 7-point scale (1= totally capable, 7= not at all capable).	Benight & Harper (2002)
	Internal Political Efficacy	6 x items, e.g.: "I think that I am as well informed about politics and government as most people" / "I think that I know as much about the politics surrounding flooding as most people," / "I think that I am as well informed about government policies that could address flooding as most people". Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	Hart & Feldman (2016)
	External Political Efficacy	3x items: "People like me don't have any say about what the government does about flooding" / "Public officials don't care much about what people like me think about flooding" / ""The government pays attention to what people like me think when they decide what to do about flooding."	Hart & Feldman (2016)
Negative affect	Anger	4 x items: I feel angry because of the way floods have been dealt with / I feel irritated because of the way floods have been dealt with / I feel furious because of the way floods have been dealt with / I feel displeased because of the way floods have been dealt with. Measured on a 7-point scale (1= Not at all, 7= very much)	Adapted for flooding context from Forgays et al. (1997)

Social appraisal	Descriptive Social Norms	How many other people do you think support this type of proposal, in the following contexts? 3 x items: In your local area (within a 15-20minute walk of your property) / In your country/nation / Amongst people who are most important to you (close family, close friends, partners etc.). Measured on a 9-point scale: (1) Almost everybody (9) Almost nobody.	New measure adapted from Lo (2013) and Truelove et al. (2015) and spatial contexts referred to in Capstick et al. (2015).
	Trust	3x items: I trust government agencies to protect people from river flooding / Government agencies care about minimizing river flooding / Government agencies are doing a competent job of protecting people from flooding. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	Griffin et al. (2008)
	Freedom threat	When thinking about how government agencies recommend that you deal with the issue of flooding, to what extent do you agree or disagree with the following statements? 4 x items ("They threaten my freedom to choose" / "They try to make a decision for me" / "They try to manipulate me" / "They try to pressure me"). Measured on a 5-point scale (1= Strongly disagree, 5= Strongly agree)	Dillard & Shen (2005)
Traits/Values	Personal Values	10 x items describing the key values in SVT, e.g.: "Power (social power, authority, wealth)" / "Achievement (success, capability, ambition, influence on people and events)", "Hedonism (gratification of desires, enjoyment in life, self-indulgence)". Measured on a 9-point scale (0= opposed to my principles, 1= not important, 4= important, 8= of supreme importance). The item for universalism was used in analysis.	Short Schwartz's Value Survey (SSVS) - Lindeman & Verkasalo, (2005)
	Trait Reactance	14 x items, e.g.: "I become frustrated when I am unable to make free and independent decisions." / "I become angry when my freedom of choice is restricted." / "It irritates me when someone points out things which are obvious to me."	Hong & Faedda, (1996)
	Place attachment	To what extent, if at all, do you feel a sense of belonging to the following areas? 4 x items: The local area where you live. By this I mean the area within a 15-20 minute walk from your home / The city or county where you live / The country/nation in which you live / Any other part of the world besides your current country/nation (Measured on a 5-point scale (1= "a very strong sense of belonging", 5= "no sense of belonging").	Capstick et al. (2015)
	Political Views	1 x item: Generally speaking, how best would you describe your political views? Measured on a 7-point scale (1= very liberal, 7= very conservative).	Feldman & Hart (2016)

*Note: Multi-item variables are represented in the analyses by the mean of their constituent items. *Measure only shown in relation to policy proposals, not behavioural proposals. **Measures only shown in relation to behavioural proposal, not policy proposal. ***Optional questions for flood affected participants only.*

In addition, several items were included in the survey but were not analysed in this chapter. These included additional supplementary measures about flood experience, efficacy, perceived risk, environmental worldview and autonomy. These measures were included for additional information, should further analysis be conducted on this dataset at a later stage. Based on implications of the previous chapter and literature review, they were not prioritised for analysis, or had conceptual overlaps with other measures already included in the analysis (e.g. relevant information about 'autonomy' was already deemed to be captured sufficiently by the measure of 'freedom threat').

4.5 Analysis

4.5.1 Descriptive statistics

Descriptive statistics, such as response frequencies, percentages and mean scores, were extracted for a range of key measures in the survey, to illustrate perceptions for the whole sample, flood victims and non-affected respondents. Graphs and charts were created to help communicate these findings, where appropriate. These outputs are organised into sections related to threat appraisals, coping appraisals, social appraisals, and other factors.

4.5.2 T-tests

T-tests were carried out to test for possible differences in appraisals between flood victims and non-affected participants. T-tests were carried out to assess group differences for a range of variables, including policy support; behavioural intentions; threat, coping and social appraisals; and other factors (e.g. place attachment).

Dependent variables were assessed for outliers via visual inspection of boxplots for values greater than 1.5 box-lengths from the edge of the box. Two potential outliers were detected. These cases were further inspected, and no unexpected values were found in their responses – thus no cases were removed before the analysis. Normality was observed in the measures of anger, coping self-efficacy, trust, freedom threat and perceived participation – following visual inspection of normal Q-Q plots. Given dredging support, climate change concern and local place attachment were single item measures, normality assumptions were not considered for these variables. Missing cases were excluded analysis-by-analysis, meaning 76 flood victims were compared against 183 non-affected participants generally. Numbers were different for the analysis of climate concern (where there were 181 non-affected participants) and freedom threat (148 non-affected).[3]

The assumption of homogeneity of variances was violated for the following variables, as assessed by Levene's test for equality of variances: Freedom threat (p= .032), anger (p= .046), participation (p= .013) coping self-efficacy (p= .031). There was homogeneity of variances in several variables, as assessed by Levene's test for equality of variances: Trust (p= .124), climate concern (p= .060), place attachment (p= .475), dredging support (p= .083). Nevertheless, given the above violations, and that there is an unbalanced design (i.e., unequal group sizes), and the differences in sample size are not unsubstantial, the Welch t-test is used for all the analyses (as recommended by Howell (2010).

[3] Due to technical error, several non-affected participants were not able to respond to the freedom threat measure during the initial stages of data collection.

Cohen's d values were calculated for significant variables, to allow clearer interpretations of effect sizes. Cohen's d indicates the distance between peaks of each group's distribution of responses, in terms of standard deviations, and takes into account size of groups. Outcomes of the t-tests are communicated in the results section below, alongside descriptive statistics, and then a table with results is provided summarising the outputs for flood victims vs. non-affected participants (*Table 4.6.2*).

4.5.3 Regression and principal component analysis

Linear regression analyses were carried out to test the applicability of an extended Protection Motivation Theory model for behavioural and policy responses, and to assess the relative importance of a range of socio-cognitive factors in explaining such outcomes. Given there were a total of nine behavioural/policy outcomes measured in the survey, ahead of the regressions, a principal component analysis (PCA) was carried out, to aggregate similar types of responses together. This helped to ensure a reasonable number of analyses were carried out.

For the PCA, five policy support variables were entered into the first analysis, and four behavioural intention measures were entered into the second analysis. It was necessary to separate the analyses as policy was assessed with a 4-point scale, and behavioural intention with a 7-point scale. For both analyses, Viramax rotation was applied with 25 maximum iterations for convergence, and with coefficients suppressed below '.3', Cases were excluded listwise. Scree plots and component plots were visually inspected to manually confirm the results of the factor groupings and identify any causes for concern. Factor loadings are shown in *Table 4.5.1* and *Figure 4.5.1*.

This analysis resulted in four new composite variables (2x policy, 2 x behavioural), which could then be used as dependent variables in linear regression. Based on the aggregated measures, the policy support variables were named *Engineering Solutions* and *Natural Solutions*; and the behavioural intentions were named *Floods Behaviours* and *Climate Behaviours*. Before the regression was carried out, means of relevant predictor variables were calculated (e.g. means of self-efficacy related to flooding behaviour were taken from both self-efficacy questions relating to property protection and flood group participation). Further details of the regression analysis are provided alongside the results.

Table 4.5:1 *- Rotated component matrix for policy support and behaviours*

		Component	
Analysis	Measure	**1**	**2**
Policy support	Hard Def (Rivers)	.800	
	Hard Def (Coastal)	.702	
	Dredging	.697	
	NFM (Coastal)		.809
	NFM Rivers		.809
Behavioural Intentions	Flood Action	.884	
	Property Protection	.877	
	Low Carbon Lifestyle		.900
	Climate Activism	.420	.700

Note: Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 3 iterations.

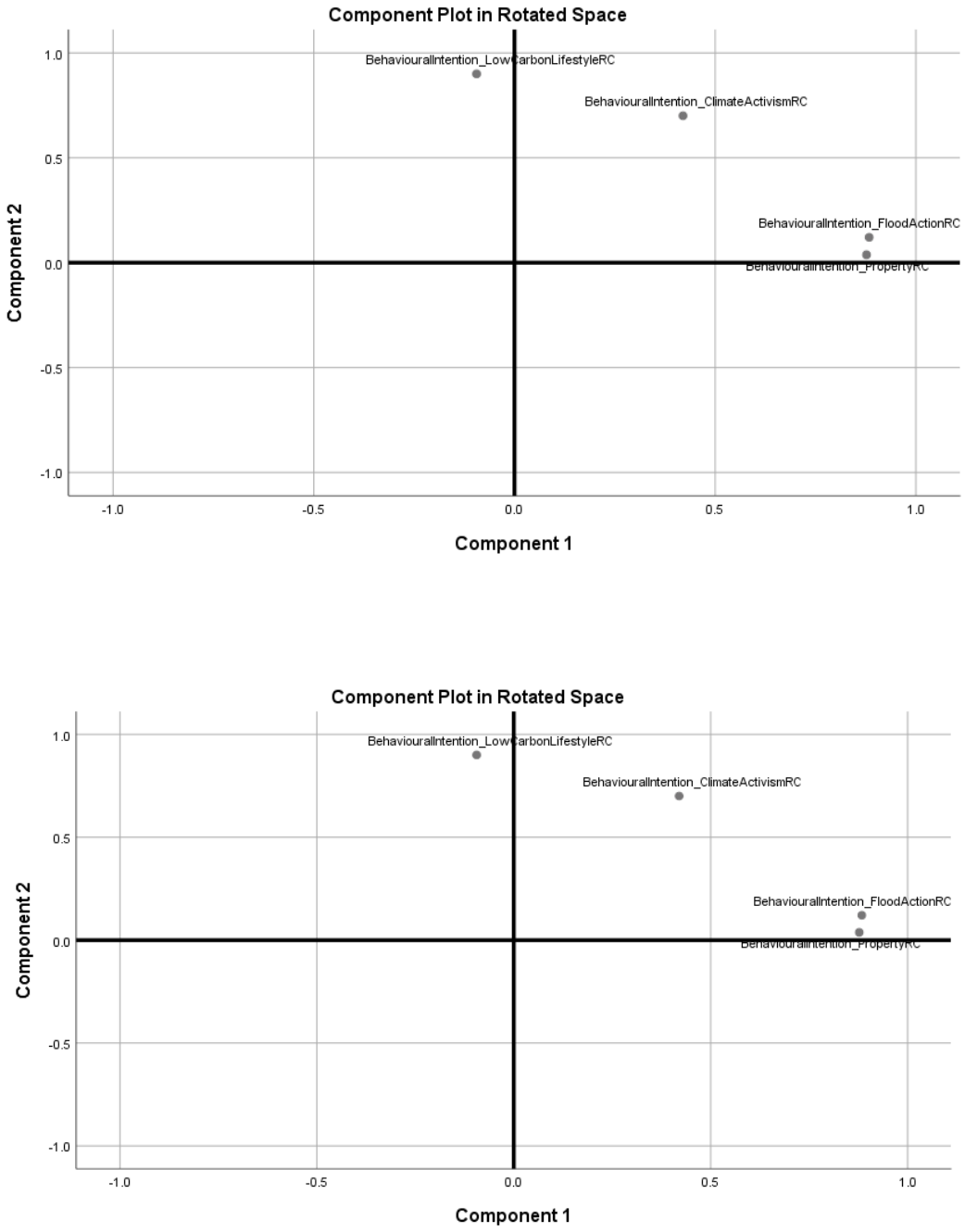


Figure 4.5:1 *- Component plots for policies (top) and behaviours (bottom) from the PCA.*

4.6 Results and discussion

4.6.1 Levels of policy support and behavioural intentions

Across the survey respondents, there was vast support for natural flood management techniques, with 96.2% of all participants saying they 'support' or 'strongly support' this measure for river flooding; and 81.5% in favour of this as a coastal solution. Majority support was also evident for hard engineering defenses for rivers (92.3% support/strongly support) and coastal environments (90.0% support/strongly support). A majority of the respondents supported dredging (59.1% support/strongly support), though this measure had the greatest opposition out of the policies as well (40.9% oppose/strongly oppose).

In terms of flood related behaviours, across the whole sample, only 28% said they were slightly-to-very likely to protect their home from flooding in the next 12 months, while 41.3% of respondents said they were likely to participate in a flood action group. In terms of climate related behaviours, 88.8% of respondents said they were likely to carry out low carbon lifestyle actions. While intentions toward climate activism were somewhat lower, this was still substantial, with just under half (47.7%) of all respondents saying they would be likely to carry this out in the following year.

So, what exactly underpins support for policy and behavioural responses? How might different social-psychological variables help to explain responses, and what can this tell us about how to communicate adaptation more effectively to encourage certain responses? The next section will address these questions.

4.6.2 Key finding 1: Efficacy variables are consistently influential and explain different levels of adaptation responses

Following insights from the previous chapter, the literature review, and findings presented above, analysis was carried out to understand the relative importance of socio-cognitive factors for determining behavioural intentions and policy support related to flooding and climate change. This analysis tested an extended Protection Motivation Theory model. The factors included *threat appraisals* (flood victim status, perceived personal susceptibility, and climate change concern), *coping appraisals* (self-efficacy, response efficacy, collective efficacy, political efficacy) *negative affect* (anger), *social appraisal* (descriptive social norms, trust, freedom threat) and *traits/values* (political worldview, universalism). The hypothesized model is shown in *Figure 4.6.1* below. Age and gender acted as control variables in this analysis.

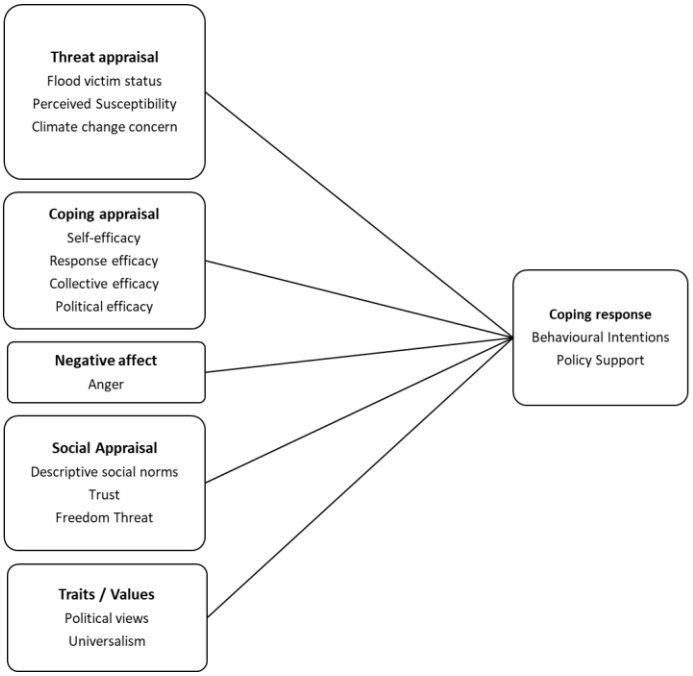


Figure 4.6:1 *- An extension of the protection motivation theory model being tested*

Due to the survey sample size, it was not possible to include all variables as predictors in the model, given there was limited analytical power available (Cohen, 1992). Predictor variables that were deemed less important were not incorporated in the analysis. Place attachment was not included given that participants were asked to appraise the behaviours and policies in general rather than 'locally' – likely obfuscating any effects. External political efficacy (feeling you have a say in flood management) was not included as its relationship to adaption responses was theorized to be mediated by self-efficacy (feeling able to do something personally), or trust, and assessing this was beyond the scope of this analysis. Measures related to stages of experience were not relevant here and were optional measures in the survey.

Four separate regression models were analyzed to predict support for two types of policies (*Engineering Solutions*, *Natural Solutions*), and intentions to carry out and two types of behavioural responses (*Flooding Behaviour*, *Climate Behaviour*). The same predictor variables (i.e. threat, coping and social appraisals, negative affect and trait/values) were entered into each, a-priori. To fit each of the models, non-significant variables were progressively removed step-by-step; the variable with the largest p-value being removed at each step (Crawley, 2012).

For each of the models there was independence of residuals, as assessed by a Durbin-Watson statistic of '1.762' (Engineering solutions), '1.986' (Natural Solutions), '1.996' (Flooding Behaviour), and '1.884' (Climate Behaviour). For each analysis, there was linearity between the dependent and independent variables and homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. VIF values were all under '2' in the final models, and no variables (including those excluded) indicated concerns regarding multicollinearity (Hair et al., 2014). Across the four analyses, nine participants were

found to exhibit a studentized residual greater than ±3 standard deviations[4], which suggested potential outliers. However, their survey responses were examined, and values did not fall outside of expected scores on the survey measures. Furthermore, no leverage values were considered risky across each of the analyses, all falling under '0.2' (Huber, 1981) and no highly influential points were found via inspection of Cooks Distance scores for values >1. Normality was observed in all the models, following inspection of a histogram of standardized residuals, as well as a Normal P-P plot of observed vs. expected residuals.

R^2 for the overall Engineering Solutions model was 65.7% with an adjusted R^2 of 65.3%, a large size effect according to Cohen (1988). Self-efficacy, response efficacy and age statistically significantly predicted Engineering Solution support, and the model was statistically significant F(3, 218)= 139.422, *p* <.001. Non-significant predictor variables were removed from the model according in the following order (*p*-values in parentheses): Gender (.912), climate concern (.633), universalism (.524), freedom threat (.504), flood victim status (.463), collective efficacy (.319), perceived susceptibility (.280), social norms (.129), trust (.138), anger (.070) and political views (.055).

R^2 for the overall Natural Solutions model was 54.1% with an adjusted R^2 of 53.3%, a large effect size according to Cohen (1988). Response efficacy, collective efficacy, anger and age significantly predicted Natural Solution support, and the model was statistically significant F(4, 217)= 63.941, *p* <.001. Non-significant predictor variables were removed from the model in the following order (*p*-values in parentheses): freedom threat (.872), perceived susceptibility (.887), social norms (.771), self-efficacy (.685), gender (.550), flood victim status (.334), climate concern (.140), universalism (.201), political views (.070), trust (.054), internal political efficacy (.079).

R^2 for the overall Flooding Behaviour model was 55.7% with an adjusted R^2 of 54.7%, a large effect size according to Cohen (1988). Perceived susceptibility, self-efficacy, anger, trust and age significantly predicted intentions for Flooding Behaviour, and the model was statistically significant F(5, 216)= 54.351, *p* <.001. Flood victim status just fell short of statistical significance (*p= .052*). Non-significant predictor variables were removed from the model in the following order (*p*-values in parentheses): universalism (.918), response efficacy (.790), climate concern (.748), collective efficacy (.453), internal political efficacy (.439), political views (.409), gender (.357), social norms (.169), freedom threat (.170) and flood victim status (.052).

R^2 for the overall Climate Behaviour model was 45.1% with an adjusted R^2 of 44.0%, a large effect size according to Cohen (1988). Climate concern, collective efficacy, internal political efficacy and universalism significantly predicted intentions for Climate Behaviour, and the model was statistically significant F(4, 217)= 44.476, *p* <.001. Self-efficacy just fell short of statistical significance (*p=.* 051). Non-significant predictor variables were removed from the model in the following order (*p*-values in parentheses): freedom threat (.865), perceived susceptibility (.672), anger (.732), gender (.378), political views (.275), trust (.257), response efficacy (.254), social norms (.248), flood victims status (.349), age (.166), self-efficacy (.051). Regression coefficients and standard errors of significant variables are detailed in *Table 4.6.1*.

[4] Breakdown was as follows: 1x participant during Engineering Solution modelling, 2x participants during Natural Solution modelling, 1 x participant during Flooding Behaviour modelling, 5 x participants during Climate Behaviours modelling.

Table 4.6:1 *- Summary of multiple regression outputs*

	Policies						Behaviours					
	Engineering			Natural			Flooding			Climate		
Variables	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
(Constant)	-4.482	.234		-3.873	.277		-3.177	.275		-4.049	.348	
Threat appraisal												
Susceptibility	-	-	-	-	-	-	.170	.027	.320***	-	-	-
Climate concern	-	-	-	-	-	-	-	-	-	.206	.081	.138*
Coping appraisal												
Self-efficacy	.191	.031	.270***	-	-	-	.307	.034	.441***	-	-	-
Response efficacy	.643	.046	.614***	.574	.056	.574***	-	-	-	-	-	-
Collective efficacy	-	-	-	.156	.043	.204***	-	-	-	.421	.045	.520***
Political efficacy (Internal)	-	-	-	-	-	-	-	-	-	.098	.035	.141**
Affect												
Anger	-	-	-	-.084	.030	-.136**	.126	.036	.199**	-	-	-
Social appraisal												
Trust	-	-	-	-	-	-	.130	.040	.170**	-	-	-
Other												
Universalism	-	-	-	-	-	-	-	-	-	.091	.029	.172**
Control variables												
Age	.094	.024	.160***	.117	.028	.202***	.113	.028	.191***	-	-	-
R^2			.657			.541			.557			.451
F			139.42***			63.941***			54.351***			44.476***

** = p < .05; ** = p < .01; *** = p < .001; B = Unstandardized regression coefficient; SE B= Standard error of the coefficient; β = Standardized coefficient. Bold text indicates headings of themes within the model. Please note that variables that were non-significant variables across all four models have been removed from this table.*

The key finding across the regression results is the crucial and consistent role that efficacy factors play in promoting behavioural and policy-oriented responses. At least one form of efficacy had a positive directional influence on each of the responses; and in all cases, efficacy factors had the greatest influence on responses, relative to other significant explanatory factors. In addition, the analysis contributes new insights around the drivers of adaptation-relevant responses by illustrating that different forms of efficacy have varying influences on different adaptive responses. Specifically, the analysis highlights that *self-efficacy* (feeling personally capable) is particularly influential where *personal-level* protective behaviours are required; *response efficacy* (belief in effectiveness) is particularly important for *policy-level* responses; and *collective efficacy* (believing together we can influence change) is most crucial for climate change behaviours, requiring broad *social-level* change.

This makes sense when considering that different responses at the personal-level, policy-level, and the collective-level represent different paths to negating serious threats. In this way, the most important form of efficacy reflected the level of change demanded by the threat. To negate direct, proximate threats to the self (e.g. flooding), individuals are required to make personal changes at the household level or in their immediate locality. Thus, self-efficacy plays the most crucial role in relation to personal-level flooding behaviours. When it comes to policies, individuals rely on governments to implement solutions. In these cases, the threat response is externalized, and so the most desirable solutions are those that appear to be most effective, rather than requiring beliefs about personal or collective capacity to implement the policies. With climate based behaviours, individuals are limited in what change they can achieve alone. Therefore, the crucial form of efficacy is the collective-level, with those who believe 'change can be brought about together' being more likely to carry out climate actions.

These insights build on the evidence presented in *Chapter 3*, by directly testing key factors in relation to tangible responses, related to flooding and climate adaptation. The present analysis confirms that self, response and collective efficacy - which were salient in the interviews - are indeed influential in shaping behavioural and policy-oriented responses to flooding and climate change. As suggested in *Chapter 3*, self-efficacy was particularly significant for personal flooding actions, and response efficacy was the most important variable for hard engineering (including dredging) responses.

These regression outputs also build on a range of past research which has addressed the antecedents of adaptation actions. The results are consistent with Van Valkengoed & Steg's (2019) meta-analyses of adaptation behaviours, which found that across a broad range of studies, self-and response efficacy were particularly influential factors for adaptive responses. However, the present research extends this work, by also addressing policy support, and clarifying that specific forms of efficacy are related to specific types of outcomes. The findings also fit with other research showing self-efficacy explains flood action (Dittrich et al., 2016) and that collective-efficacy can predicts collective adaptation actions, such as water conservation (Thaker et al., 2016). Given that different forms of efficacy can help or hinder adaptation at different response levels, this work also adds new insights around the social limits of adaptation. This builds on past research about the subjective limitations of values (see: O'Brien, 2009) and social barriers (Jones, 2010) for adaptation.

Given that the models explained a substantial amount of variance in all cases (ranging from 44%-65% of variance), the application of Protection Motivation Theory was validated in this context. The significance of threat and coping appraisal factors, in relation to flooding and climate change behaviours, was consistent with the original model (Rogers, 1975) and meta-analyses of PMT (Floyd et al., 2000; Witte & Allen, 2000). Interestingly though, threat appraisals seemed to matter more for personal behaviours as no threat appraisal factors significantly influenced policy support. This is interesting, as it suggests policy support is not necessitated by perceived susceptibility to flooding or concern about climate change. Instead efficacy beliefs were much more important here. Despite this, the policy models still explained very high amounts of variance (54-65.3%), showing the extended PMT model was still applicable for explaining policy support.

The significance of additional variables, such as climate change concern, collective efficacy, internal political efficacy, trust, and anger in specific models, shows that extending the model further is worthwhile. For instance, collective efficacy was the most influential factor for climate focused actions, suggesting PMT should be adapted for such collective focused responses, while trust in government was associated with flooding action intentions (+), and anger was a significantly predictor of flooding behaviours (+) and natural flood management (-). This builds on previous work which also finds significance of negative affect (van Valkengoed & Steg, 2019), climate change perceptions (Brügger et al., 2015), and trust (Koerth et al., 2013) for climate adaptation.

However, not all additional variables were significant. While *flood experience* (i.e. flood victim status) was on the cusp of significance in relation to flood actions, it was not significant for any of the outcomes. This contrasts with research which has found that flooding experience is related to protective actions (e.g. Działek et al., 2016; Elrick-Barr et al., 2016). However, it is not wholly surprising given meta-analysis shows experience tends to be less influential compared to other factors (Van Valkengoed & Steg, 2019), and some studies do not find effects of experience on adaptive responses (Chaney et al., 2011; Hall & Slothower, 2009). The result may be explained by experience being treated as a binary categorical variable, rather than a measure of intensity of impact. However, researchers have argued that the form of measurement does not explain heterogeneous findings in the literature regarding experience (van Valkengoed & Steg, 2019). Instead, what seems more likely is that effects of experience on behaviour are indirect, given a growing body of research shows effects of experience are mediated via threat and coping appraisals (Spence et al., 2011; van Valkengoed & Steg, 2019), or interact with political orientations (Ogunbode et al., 2017, 2018).

Surprisingly, *descriptive social norms* were non-significant in all models, contrasting with previous research which show a clear positive association with adaptation behaviours (Lo, 2013; van Valkengoed & Steg, 2019). One possible explanation is that *local norms* were entered into the model, but participants were asked to review responses *generally*, rather than locally, making norms less influential. Another explanation is that the method of measuring descriptive norms was somewhat unorthodox and may not have been valid (see methods). It therefore does not seem reasonable to fully discount norms from this research, and further study should continue to assess their role in relation to flooding actions.

Political views were non-significant across the models, and *values (i.e. universalism)* only had significance in relation to climate behaviours (i.e. low carbon lifestyle choices and climate activism). Given the climate actions measured could be viewed as mitigation oriented behaviours, this gives further weight to the idea that mitigation behaviours are values based, while adaptation behaviours are not – and fits with other research suggesting this (Zhang et al., 2020). This also adds weight to the assumption in the literature review that there are different ways in which people can feel threatened – whether that is values based, or realistic physical threats. Interpreting the present findings through this lens, people who placed greater value on universalism (i.e. concern for equality and nature) were more likely to engage in problem focused-coping around climate change, but not in relation to flooding – while people who felt personally threatened by the physical aspects of floods, were more likely to engage in problem-focused coping to tackle flooding.

Finally, perceived *freedom threat* was non-significant across the models. This suggests that feeling restricted by authorities is generally not an influential factor for policy and behavioural responses. This contrasts with the previous chapter findings. Broadly, this suggests that adaptation responses are not carried out as a reactant response, despite some research showing the role of reactance in relation to environmental behaviour change (Kronrod et al., 2012; Murtagh et al., 2012). However, given data collection for this study was carried out across a substantial time period, this does not rule out the possible influence that short-lived, contextual reactance may have – such as those reported in the previous chapter. Past research suggests that reactance tends to be more relevant when assessing immediate responses to persuasive requests (Dillard & Shen, 2005). The ways that short lived, immediate freedom threat could influence responses to requests would be interesting to address in more detail in relation to communications interventions.

4.6.3 Key finding 2: Flood victims and non-flood victims differ in threat, efficacy and social appraisals

While personal experience of flooding was not found to be a significant direct predictor of behavioural intentions or policy support in the regression analysis above, the results of t-tests showed that personal experience of flooding does nevertheless have some interesting influences on threat, coping and social appraisals. Analysis showed that flood victims had significantly different threat, coping and social appraisals related to flooding. A breakdown of differences between flood victims and non-affected participants is covered in the following sections, and a summary of between group tests is provided in *Table 4.6.2*.

4.6.3.1 Policy support and behavioural intentions

Comparing subgroups in the sample revealed that flood victims had much higher levels of support for dredging (73.7% support/strongly support) than those affected by flooding (53.0% support/strongly support). Support for dredging and hard engineering was found to be significantly higher for flood victims, compared to non-affected participants. The differences were substantial for both dredging (d= 0.65, p <.001), and hard engineering on rivers (d= 0.53, p <.001). There were no significant differences found for other policies. *Figure 4.6.2* shows a breakdown of support for policies between the subgroups.

This builds on the previous chapter's findings, by confirming statistically that dredging has significantly higher support amongst flood victims. This also builds on previous

research with flood victims in Somerset, which finds majority support for dredging (Butler et al., 2016). The majority support for natural flood management here also suggests that there is a clear mandate for such techniques from both flood victims and non-affected publics.

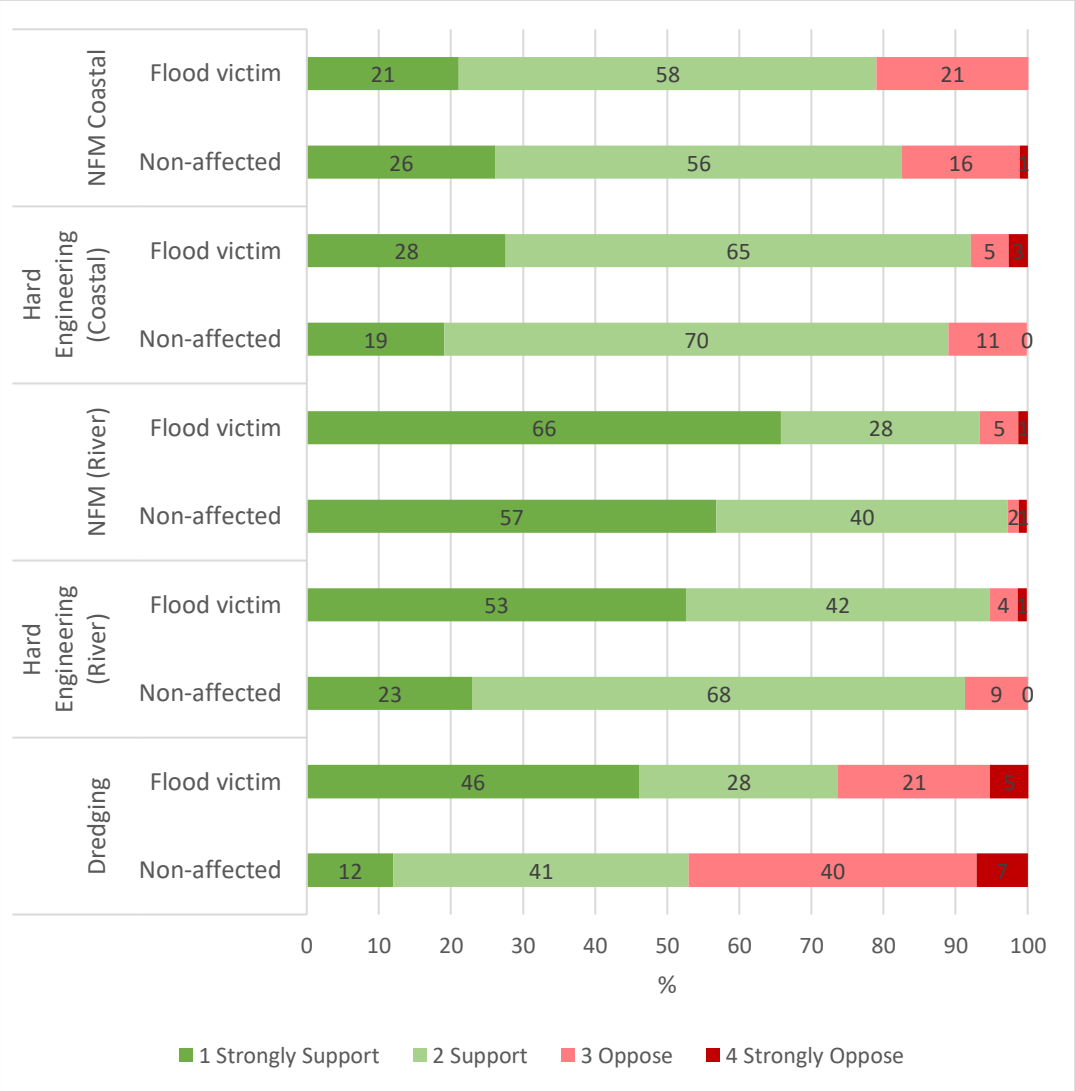


Figure 4.6:2 *- Policy support amongst the survey respondents*

Intentions for household flood protection were much higher amongst flood victims, with 48.7% saying they intended to protect their property in the next year (see *Figure 4.6.3*). The group difference was significant, and large (d= 0.91, *p* <.001). Likelihood of participating in a flood action group, again was also higher amongst the flood victims, with nearly three quarters (71.1%) saying they were likely to participate, compared to 29.0% of those not affected. This again equated to a large significant difference in support, with flood victims being much more likely to engage with flood action groups (d= 0.98, *p* <.001).

There were no differences found between the flood victims and non-affected participants around climate actions. This specific finding contrasts somewhat with past research, which found that experience of flooding has an indirect effect on climate mitigation actions, related to energy consumption (Spence et al., 2011). However, some caution should be taken here, given there were group differences in

universalism values, which were associated with climate actions in the regression model.

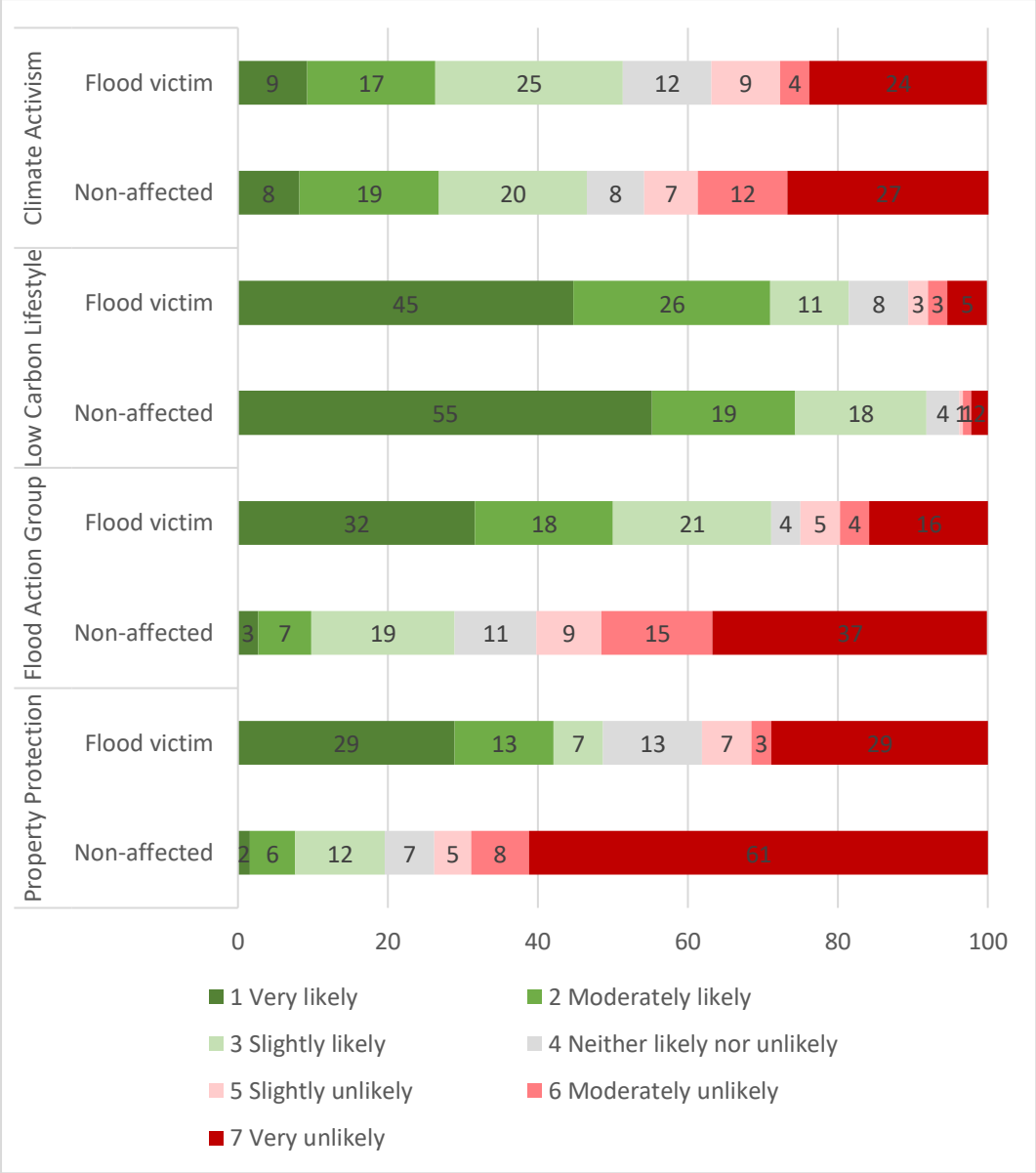


Figure 4.6:3 *- Behavioural intentions amongst the survey respondents*

These results appear to support past research where direct experience of flooding has been associated with protective flooding behaviours (Działek et al., 2016; Elrick-Barr et al., 2016). It also seems to contradict suggestions that experience can lead to optimism bias, or an overwhelming sense of fatalism (Ejeta et al., 2015; Gifford, 2011; Marshall, 2014). So why wasn't experience picked up in the regression model as a significant factor? The following sections suggest that experience is associated with differences in threat, coping and social appraisals (i.e. variables that *were* significant in the regression model). Thus, the effects of experience on people's responses might be *mediated* via these variables, rather than direct.

Table 4.6:2 *- Summary of t-tests for perceptional differences between flood victims and non-flood affected participants*

Category	Variable	Group	N	M	SD	t-value	df	*p*-value	Mean Difference	Cohen's d
Policy support	**Support for dredging*** **	**Non-Affected**	**183**	**2.58**	**0.79**					
		FloodVictim	**76**	**3.14**	**0.93**	**4.63**	**122.19**	**.000**	**0.57**	**0.65**
	Support for hard defences (Rivers)* **	**Non-Affected**	**183**	**3.14**	**0.55**					
		FloodVictim	**76**	**3.46**	**0.64**	**3.79**	**122.37**	**.000**	**0.32**	**0.53**
	Support for NFM (Rivers)	Non-Affected	183	3.53	0.59					
		FloodVictim	76	3.58	0.66	0.56	127.69	.576	0.05	
	Support for hard defences (Coastal)	Non-Affected	183	3.08	0.54					
		FloodVictim	76	3.17	0.64	1.06	122.06	.290	0.09	
	Support for NFM (Coastal)	Non-Affected	183	3.08	0.68					
		FloodVictim	76	3.00	0.65	-0.85	146.18	.399	-0.08	
Behavioural Intention	**Intention property protection*** **	**Non-Affected**	**183**	**2.25**	**1.83**					
		FloodVictim	**76**	**4.21**	**2.45**	**6.28**	**111.10**	**.000**	**1.96**	**0.91**
	Intention low carbon lifestyle	Non-Affected	183	6.12	1.29					
		FloodVictim	76	5.74	1.68	-1.79	113.66	.077	-0.38	
	Intention flood action* **	**Non-Affected**	**183**	**2.93**	**1.89**					
		FloodVictim	**76**	**4.92**	**2.15**	**7.00**	**125.50**	**.000**	**1.99**	**0.98**
	Intention climate activism	Non-Affected	183	3.70	2.14					
		FloodVictim	76	3.99	2.05	1.01	145.89	.312	0.29	
Threat appraisal	**Perceived personal susceptibility to flooding in next 2 years*** **	**Non-Affected**	**183**	**2.52**	**1.49**					
		FloodVictim	**76**	**4.61**	**2.13**	**7.77**	**106.74**	**.000**	**2.08**	**1.14**
	Climate concern	Non-Affected	181	3.43	0.63					
		FloodVictim	76	3.36	0.74	-0.72	123.00	.473	-0.07	

Coping appraisal	**Dredging self-efficacy*** **	**Non-Affected**	**183**	**3.05**	**1.63**					
		FloodVictim	**76**	**4.46**	**1.89**	**5.66**	**123.44**	**.000**	**1.41**	**0.80**
	Dredging response-efficacy **	**Non-Affected**	**183**	**4.79**	**1.49**					
		FloodVictim	**76**	**5.51**	**1.67**	**3.29**	**127.51**	**.001**	**0.73**	**0.46**
	Dredging collective-efficacy* **	**Non-Affected**	**183**	**3.73**	**1.62**					
		FloodVictim	**76**	**4.78**	**1.83**	**4.32**	**126.49**	**.000**	**1.04**	**0.66**
	Internal political-efficacy* **	**Non-Affected**	**183**	**3.99**	**1.29**					
		FloodVictim	**76**	**5.24**	**1.25**	**7.27**	**145.09**	**.000**	**1.25**	**0.98**
	External political-efficacy*	**Non-Affected**	**183**	**4.37**	**1.08**					
		FloodVictim	**76**	**4.73**	**1.32**	**2.09**	**118.99**	**.039**	**0.36**	**0.30**
	Coping self-efficacy * **	**Non-Affected**	**183**	**4.66**	**1.04**					
		FloodVictim	**76**	**5.33**	**1.25**	**4.13**	**119.46**	**.000**	**0.67**	**0.58**
Negative affect	**Anger *** **	**Non-Affected**	**183**	**3.81**	**1.46**					
		FloodVictim	**76**	**4.73**	**1.78**	**3.98**	**119.26**	**.000**	**0.92**	**0.56**
Social appraisal	Freedom threat	Non-Affected	148	2.53	0.86					
		FloodVictim	76	2.76	1.08	1.60	125.25	.113	0.23	
	**Trust ** **	**Non-Affected**	**183**	**3.78**	**1.25**					
		FloodVictim	**76**	**3.18**	**1.41**	**-3.26**	**126.61**	**.001**	**-0.61**	**0.46**
	Dredging perceived local norm* **	**Non-Affected**	**183**	**5.04**	**2.12**					
		FloodVictim	**76**	**6.34**	**2.35**	**4.16**	**128.22**	**.000**	**1.30**	**0.58**
Belonging	**Local place attachment *** **	**Non-Affected**	**183**	**3.52**	**1.11**					
		FloodVictim	**76**	**4.14**	**1.07**	**4.25**	**145.27**	**0000**	**0.63**	**0.57**

** = p < .05; ** = p < .01; *** = p < .001*

4.6.3.2 Threat appraisals

There were clear differences within the sample around risk perceptions, as 60.5% of flood victims believed they were susceptible in the next 2 years, compared to just 12.6% of participants that had not previously been affected (see *Figure 4.6.4)*. The difference in agreement about perceived susceptibility was statistically significant and equated to a very large effect size (d= 1.14, *p* <.001), with over one standard deviation difference between the sub-groups. Again, this contrasts with literature suggesting direct experience of hazards can lead to optimism bias (e.g. Marshall, 2014; Suls et al., 2013), or fatalism (e.g. Ejeta et al., 2015).

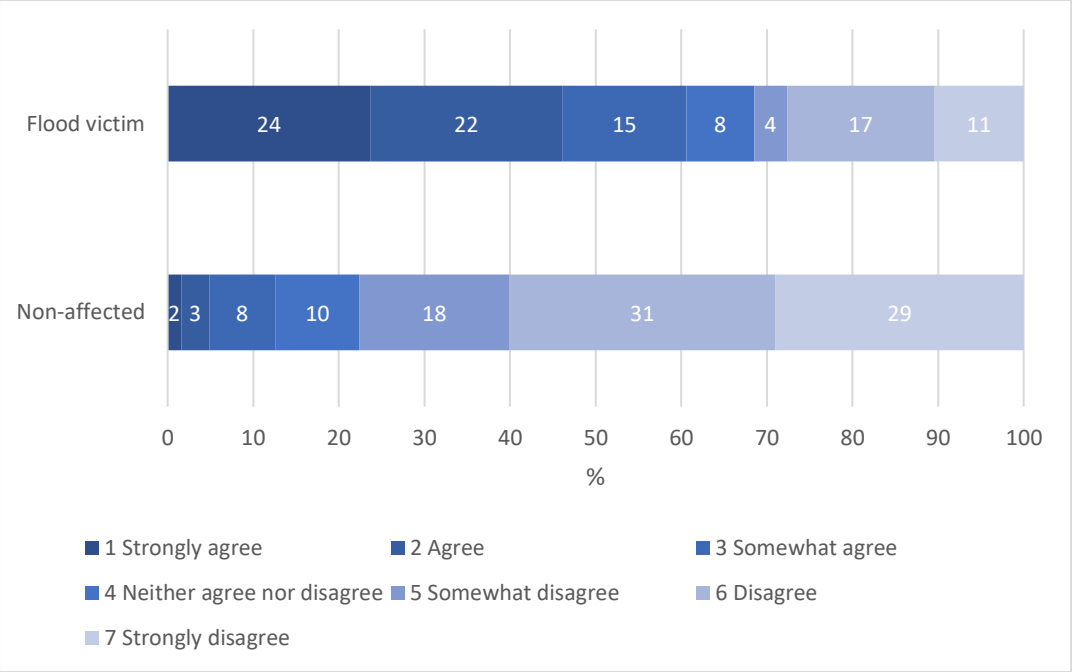


Figure 4.6:4 *- Agreement with the statement: "In the next 2 years, my current home/property is at risk of being flooded from river, coastal, groundwater or surface water flooding"*

Just over half of the participants considered that climate change is “mainly caused by human activity” (51%), with fewer saying it is “entirely caused by human activity” (20.5%; see *Figure 4.6.5*). Around a quarter considered it to be “partly caused by natural processes and partly caused by human activity” (28.2%). The proportion of participants who were very or fairly concerned about climate change was relatively lower amongst flood victims (86.8%), compared with non-affected participants (93.4%).

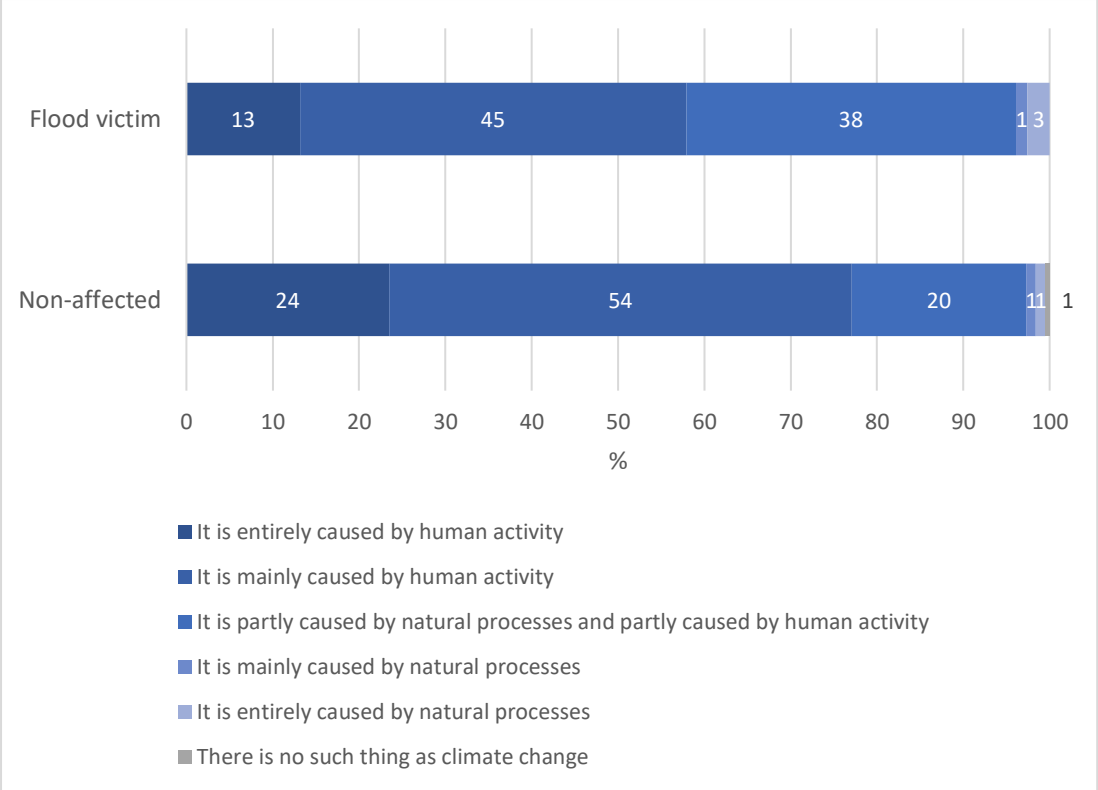


Figure 4.6:5 *- Beliefs about the causation of climate change*

In terms of climate change concern, across the whole survey sample, 91.5% said that they were 'very' or 'fairly' concerned about climate change, while only 7.8% were 'not very' or 'not at all' concerned (see *Figure 4.6.6)*. No significant difference was found between flood victims and non-flood affected participants for climate change concern (p= 0.47). This is in line with some previous studies which have also not found differences in concern due to experience of flooding (Dessai & Sims, 2010; Whitmarsh, 2008), and contrasts with other work which has found that experience increases climate change concern (Capstick et al., 2015; Demski et al., 2017). Again, some caution is warranted here given there was a significant difference in trait universalism values between the groups in this survey. This is important to note, given recent analysis has shown that political values interact with experience of flooding to influence climate perceptions (Ogunbode et al., 2017, 2018).

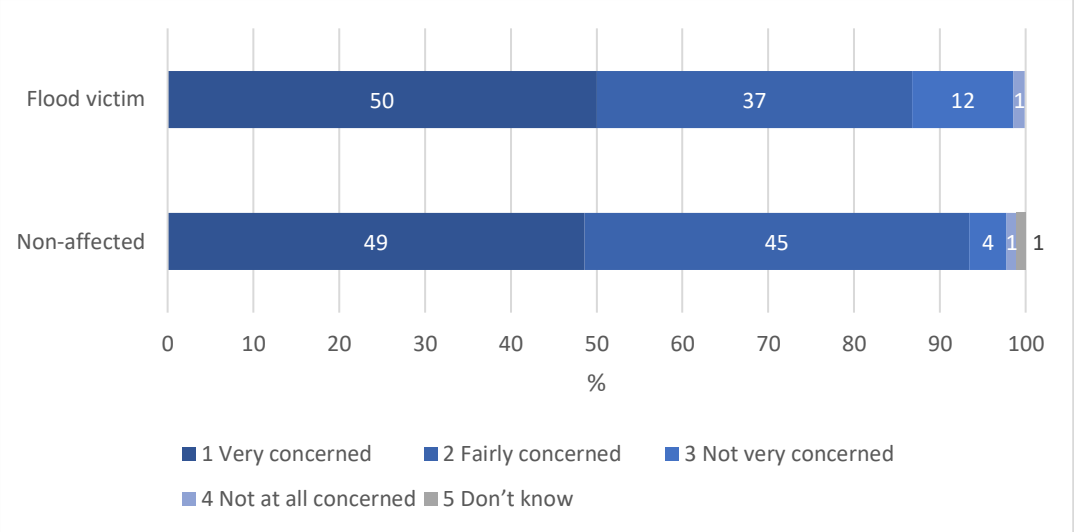


Figure 4.6:6 *- Climate change concern amongst survey respondents*

4.6.3.3 Coping appraisals

In terms of *coping self-efficacy* (i.e. feeling able to cope with the range of problems posed by flooding) flood victims scored higher than non-flood victims. The difference was significant, with a medium-to-large effect size (d= 0.58, *p* <.001). In addition to this, flood victims reported greater *internal political efficacy* (i.e. feeling well informed about the political issues surrounding flooding). This suggests that broadly speaking, flood victims feel more informed, and more able to cope with the general challenges of flooding compared to people who have not experienced flooding. This is promising to note, given past research has highlighted the importance of coping self-efficacy for wellbeing in relation to disasters (Benight & Harper, 2002), and again, this contrasts with research suggesting that direct experience exacerbates fatalism (Ejeta et al., 2015).

Following the key findings uncovered in the previous chapter, response specific efficacy beliefs were addressed in relation to dredging. Firstly, flood victims in the survey reported significantly greater *response efficacy* beliefs towards dredging – perceiving dredging to be more effective for reducing flood risks, than non-affected participants (d= 0.48, *p*= .001). This directly supports the inductive analysis in the previous chapter – which identified response efficacy to be a key factor associated with heightened support for dredging amongst flood victims. Secondly, in the survey, flood victims also reported greater *self-efficacy* towards dredging – i.e. feeling personally able to do something to ensure dredging is implemented. This difference was significant and substantial, with 0.8 of a standard deviation between the groups (d= 0.80, *p* <.001). In the previous chapter, self-efficacy was found to be highly salient and so this statistical difference confirms that the qualitative work picked up on something important. Furthermore, flood victims had a greater sense of collective efficacy, that together they could do something to ensure dredging was carried out (d= 0.58, *p* <.001). Again, this adds weight to the findings in *Chapter 3*, which suggested collective efficacy to be salient.

Interestingly, *external political efficacy* (i.e. perceived participation in decisions about flooding) was also found to be higher amongst flood victims in the survey. The difference was significant, and represented a small-to-medium effect size (d= 0.30,

p= .040). This suggests that flood victims generally felt more included in decision making around flooding, than those not affected. It is possible that collaborative engagement activities with flood victims, such as catchment management planning (e.g. WCCP, 2020), has heightened perceived participation in policy design. This would make sense, given past work has shown that participation in a flood action group can increase people's efficacy beliefs (Dittrich et al., 2016).

While these findings show significant differences in efficacy, there is some contrast with the previous chapter, which proposed that efficacy was inhibited (i.e. reduced) by flood management authorities in Cumbria. These findings are not wholly inconsistent though and there are several possible explanations for what appear at first to be contrasts. Firstly, there may be differences in efficacy that are *contextual.* It is possible that efficacy could be lower in Cumbria (where interviews were conducted), compared to other regions. This seems unlikely though, given past research has found that Cumbrian residents had strong beliefs about the need to take personal responsibility for flooding (Adger et al., 2012). A second explanation is that the inhibition of efficacy in Cumbria may have been *temporary* i.e. a short-lived experience around the time of the winter 2015/16 floods. Given data collection for this survey was carried out after these floods, it is possible that efficacy had time to be restored or increased, perhaps as individuals carried out flooding protection, and government intervened. In line with this second explanation, is possible that people's efficacy in Cumbria was always high, and that is why the inhibition was particularly salient, in the previous chapter. It seems plausible that if one feels very able to carry out a response to flooding, but is then prevented by an external factor, this would lead to greater anger than if one did not feel able to carry out a response in the first place.

4.6.3.4 Negative affect (anger)

Anger was found to be significantly higher among flood victims compared to non-affected participants and this was a medium size effect (d= 0.56, *p* >.001). This highlights greater negativity amongst flood victims than other members of the public. This aligns with other research that showing that direct experience of flooding, and government management of floods, can lead to negative emotional outcomes (Griffin et al., 2008; Messling et al., 2015; Walker-Springett et al., 2017). This is important to note, given that studies have shown negative affect to be related to adaptive responses (van Valkengoed & Steg, 2019). It is also interesting to note that anger was higher despite there being heightened coping self-efficacy and perceived participation (see section above). This perhaps suggests that current efforts by government to manage floods have not been sufficient to reduce the frustration felt by flood victims. This is important, as negative affect can be associated with negative wellbeing outcomes for flood victims in the longer term (e.g. Foudi et al., 2017).

4.6.3.5 Social appraisals

In addition to anger, scores for *trust in government* were significantly lower among flood victims. This difference in trust was about half a standard deviation from non-affected participants (d= 0.46, *p*= .001). However, there were no differences between the groups in terms of perceived freedom threat. In other words, flood victims *did not* feel that government agencies threatened their freedom to make choices about flooding any more than other respondents. The idea, presented in the previous chapter, that the authorities threatened flood victims' sense of freedom was not

founded here. Like the findings on efficacy though, this does not rule out that freedom threats could have occurred contextually in Cumbria, or temporarily around the time of the winter 2015/16 floods.

Following the previous chapter, local descriptive norms around dredging were investigated. This survey found that there was a significant difference here, with flood victims tending to report that more people in their local area support dredging. This difference was substantial (d= 0.46, p <.001). This makes sense given there was majority dredging support amongst flood victims in the survey. This builds on findings in the previous chapter, and research which finds majority support for dredging (e.g. Butler et al., 2016) by confirming that flood victims perceive dredging support to be socially normal. While descriptive norms were not significant in the regression model, this is still important to note, given other studies have found a role of norms in relation to adaptation (Lo, 2013; van Valkengoed & Steg, 2019).

4.6.3.6 Belonging

Attachment to local place (i.e. sense of belonging in one's immediate local area) was found to be significantly higher amongst flood victims compared to non-affected participants – a difference that was quite substantial at 0.57 of a standard deviation. This adds weight to findings in the previous chapter that (a) there was a clear need for belonging amongst flood victims, and that (b) belonging may be increased due to social support in the aftermath of flooding. This relates well to research that has found communities tend to bond in the aftermath of flooding, as individuals offer social support to one another (Butler et al., 2016; Walker-Springett et al., 2017). However, while there was a significant difference between groups, it is not possible to conclude the directionality of this effect. For instance, it is not clear whether people who were already attached to their locality choose to remain, despite being affected by flooding, or whether flooding fosters a sense of belonging within the community to create the difference. Therefore, it is not possible to wholly discount research which finds no effect of experience on place attachment (Clarke et al., 2018).

4.6.3.7 The possible indirect effects of personal experience

In sum, the group differences above suggest that indirect effects of flood experience cannot be discounted altogether. The direct effects of personal flood experience were not found to be significant in the regression model above, and literature concerning effects of hazard experience on adaptation behaviour is mixed (see *Chapter 2*). However, the above findings about subgroup differences suggest that the influence of personal experience on policy support and behavioural intentions could be mediated via influences on various threat, coping and social appraisals. This would align with past research which has shown that experience has a non-significant direct effect on climate behaviour, but is mediated via threat and coping appraisals (e.g. Ogunbode et al., 2019; Spence et al., 2011). Given this project's interest in dynamic socio-cognitive factors that can be influenced by communications, rather than static factors like personal experience which cannot be changed through such interventions, further analysis around personal experience is beyond the scope of this research. Nevertheless, this would be interesting for researchers to assess in future work.

4.6.4 Key finding 3: 'Seeing is believing' for confirmation of the threat

Finally, it is worth reporting that some flood victims answered optional follow up questions relating to the stages of flooding experience (n=47). These questions were designed to relate to the stages of flooding model, presented in the previous chapter.

A key aspect of the hazard warning process is confirmation of the threat (Sorensen & Sorensen, 2007). On recalling their experiences, almost half of the participants (46.81%) said they were only convinced they would be personally flooded when they could see the floodwaters with their own eyes. Surprisingly, only 10% reported that they became convinced upon receiving an official warning. 8.51% said they were convinced once the floodwater was already in their property, 6.38% due to reports on the TV/Radio, and 4.26% were convinced by word of mouth. Just under a quarter (23.40%) gave 'other' reasons (e.g. "When I arrived home having no warning that flooding would occur", and "I heard the sound of the rain outside change from 'rain on concrete' to 'rain on water"). This suggests that directly *seeing* the floodwaters was a pivotal event for those affected, alongside other less formal cues.

These findings are interesting, as they highlight the importance of informal markers of flood risk, especially visual markers. The findings resonate with work concerning bushfires in Australia (Handmer et al., 2019). Via a survey of affected residents, this work found that a substantial number (32%) first became aware of the bushfire through sensory cues from the environment (e.g. smoke, fire embers). The next most common cue was from family, friends or neighbours (21%), and, similarly, to the present study, a small minority (8%) were alerted initially via 'official' warnings (such as radio, emergency personnel, internet or television). The importance of sensory cues here, especially visual cues, may suggest that imagery can play a key role in highlighting climate risks. Additionally, while these findings relate to people directly affected by hazards, more broadly, it might also suggest an important role of being able to form mental pictures of hazards. This is addressed later in *Chapter 7*.

In addition, participants were asked about their experience of 'waiting', given this was salient in the previous chapter. Just under a half of participants (44.68%), said they *recall a distinct period of waiting (i.e. a period of 'inaction', or 'delaying action')* once the floodwaters had entered their property. 29.79% said they did not experience this, and 25.53% selected 'unsure/don't know. This is important as feeling there is 'nothing more you can do' can relate to a lack of efficacy (Fox-Rogers et al., 2016). Together, this reinforces the idea that efficacy may be inhibited by the threat of flooding (at least temporarily), as suggested in the previous chapter.

Together, these findings add further depth of insight into the stages of experience model presented in the previous chapter, validating the inclusion of threshold events (like seeing floodwaters) and a common phase of waiting. These results suggest that formal warning messages are likely to be discounted during hazards, posing a further challenge for communicating imminent flood risks. This again highlights a great need to find effective ways to communicate about risks associated with climate change.

4.7 Conclusion

This chapter has explored the perceptions of flood victims and the general public in relation to flooding and climate change responses. The most significant finding of this chapter is the clear and consistent role of efficacy in relation to behavioural and policy responses, and that different forms of efficacy were influential for different levels of responses. Specifically, it was found that:

1. People have greater intentions to carry out flooding behaviours if they perceive higher self-efficacy (i.e. personally they feel able to carry out the action)
2. People tend to support policies related to flooding (e.g. engineering and NFM) if they perceive high response-efficacy (i.e. the policy will be effective in reducing the negative effects of flooding)
3. People have greater intentions to carry out climate change focused actions if they perceive greater collective-efficacy (i.e. believing that together we can do something about the issue).

In addition to this, a set of differences between flood victims and non-affected survey respondents were highlighted. Of note was the substantially greater support for dredging amongst flood victims, broadly higher efficacy, and lower trust in government. No differences were found between flood victims and other members of the public around climate change concern, though, as stated this result should be treated with caution due to subgroup differences in values. This study compliments the findings in the previous chapter, particularly around the salience of efficacy. A summary of hypothesis testing is presented in *Table 4.7.1*.

Table 4.7:1 *- Summary of hypothesis testing*

Hypotheses	**Outcomes**
H1: (a) Policy support and behavioral willingness related to flooding will be significantly predicted by an extended Protection Motivation Theory model incorporating threat, coping, and social appraisals, negative affect and traits/values (b) self-efficacy will be more influential than response efficacy, and collective efficacy across the outcomes variables.	(a) Supported (b) Not supported – At least one efficacy variable was significant in all models tested. Self-efficacy, response efficacy and collective efficacy were not always significant together for all 4x of the outcomes tested.
H2: (a) Support for natural floods management and (b) climate change actions will be significantly positively associated with universalism values, while (c) hard-engineering and dredging will be negatively associated.	(a) Not supported (b) Supported (c) Not supported
H3: (a) Flood victims will express significantly different perceptions related to (a) responses to flooding (b) a range of threat, coping and social appraisal factors, and (c) belonging. However (d) there will not be any differences in climate-focused perceptions, intentions or policy support.	(a) Partially supported (significant differences were found for responses, except NFM or coastal defenses) (b) Mostly supported (differences were found for all variables, except for freedom threat) (c) Supported (d) Supported

4.7.1 Research strengths and limitations

This survey research had some notable limitations:

- This study was cross sectional, and therefore cannot confirm causality of influence of factors.
- The study focused on intentions and support and did not monitor real world behaviours.
- Flood victims and members of the public had different values and political views, which could have biased other results relating to differences between the groups (e.g. climate change concern). This limitation was possibly introduced via self-selection bias during recruitment concerning the non-affected respondents.
- Experience of flooding was considered as binary, rather than a scale of impact intensity, which may have yielded different results.

Nevertheless, the research has strengths in that it has provided:

- A study design and sample size that allowed power to test relationships between variables via regression, and differences between subgroups, as per Cohen (1992).
- A sample with participants from a range of ages, and locations across the UK, and experiences with flooding – increasing generalizability and ecological validity of findings.
- Quantitative testing of variables, which in combination with the previous chapter, offers triangulation of evidence around the roles of threat, coping and social appraisals for determining responses.
- New quantitative insights into both flood victims' and non-flood affected participants' perceptions, experiences and response appraisals.
- Analysis of factors that have little been addressed in previous research relating to floods and climate adaptation.

4.7.2 Key implications for communicating adaptation

This chapter suggests that to more effectively encourage adaptive responses to climate change and specific hazards like flooding, practitioners should aim to nurture a sense of efficacy. To do this particularly effectively, the type of response level that is being proposed should be considered in detail, a-priori. Are personal level actions, policy-level responses, or broader, collective-level responses the focus of the piece of communication? Depending on the response level, a different form of efficacy is likely to be relevant. If aiming to encourage personal-level responses to proximate, or direct threats (such as household flood protection), then attempt to nurture *self-efficacy*. This could involve fostering beliefs about personal capacity to carry out the actions, via verbal persuasion, or by giving examples of other people taking actions. To encourage policy support, focus on nurturing a sense that the solution will be effective at negating the threat of climate hazards. (Note that this may be a particularly effective way to communicate alternatives to dredging, given beliefs about effectiveness predicted support for natural floods management as well as hard engineering solutions). Finally, if aiming to encourage climate action, it makes sense to address collective-efficacy. To do this, communicators should utilize messages to increase beliefs that change can be brought about together. In addition to these key implications, communicators may also benefit from addressing other factors that were significant in the regression models, such as anger and trust in relation to

flooding, and for climate specific actions (only) – making connections with concern, and universalism values.

4.7.3 A note on the thesis structure following this chapter

Following the results of this chapter, the interviews in *Chapter 3,* and the literature review, several pressing questions remain around communicating adaptation. The thesis now forks to address two key issues that warrant further investigation:

a) Given there was majority support for what is seemingly a maladaptive policy (dredging), further investigation is warranted to understand the role that a majority (or minority) status might play in determining people's responses to critical communications about their behaviour *(Chapters 5 & 6).*

b) In terms of communicating with the general public (rather than flood victims), how does flooding compare with other issues in terms of people's threat appraisals (i.e. sense of personal vulnerability)? What drives the general public's adaptive actions, and what kinds of communication styles work most effectively? *(Chapter 7)*

These questions will now form the basis of the following chapters, as noted here.

Chapter 5

A lab study investigating the role of majority-minority status in responses to confrontational communication

Image: “Audience” by emile guillemot, reproduced with permission

5.1 Abstract

The previous chapter highlighted there is majority support for dredging, particularly amongst flood victims. Other behaviours that have negative implications for the environment also have majority status in the UK (e.g. car use, using air travel, or meat consumption). Previous research suggests that individuals seek not to be positioned in minorities, and that the effects of persuasion can be diffused amongst large groups via a "divisional effect". However, no studies have assessed at a fundamental level whether a majority (versus minority) position alone is enough to buffer individuals from potentially threatening communication about current behaviour. The aim of this chapter is therefore to empirically test the idea that majorities, by nature, offer group members protection from external criticism. To test this, an experimental lab study (N=92) was conducted to investigate whether a simple priming of perceived descriptive norm status (i.e. majority vs. minority vs. control) influenced peoples' responses to criticism about their behaviour during a card sorting task. The study was designed to strip away all potentially confounding factors and preconceptions – meaning that any differences observed were occurred at the most minimal of levels. To assess possible differences thoroughly, the lab study utilized both implicit (physiological) and explicit (self-reported) measures of stress and stimulation. Contrary to expectations, analysis showed no significant differences between majority, minority and control conditions for physiological, or self-reported measures. Though non-significant, the study was suggestive of an effect whereby willingness to change choice is higher in majority groups, compared to minority and control groups. The latter result warranted further investigation with a larger sample size, and application to 'real world' climate relevant issues.

Highlights

- A lab study with 92 participants was carried out to understand whether, at a minimal level, majority status helps individuals to cope with criticism of their current behaviour.

- Descriptive norm status (i.e. majority vs. minority vs. control) was manipulated prior to criticism, and responses were recorded using physiological equipment and self-report measures.

- No significant differences were found between the norm conditions for behavioural intentions, and there were no interactions between condition and time (i.e. pre-post criticism) in terms of implicit and explicit stress and stimulation.

- The majority group appeared to be more willing to change behaviour following admonishment – but this was also not significant.

5.2 Introduction

The previous two chapters have highlighted majority support for dredging as a solution to flooding, despite its negative implications for people, ecology, and lack of expert endorsement. Almost three quarters (73%) of flood victims in *Chapter 4* supported dredging. This is just one example of a (seemingly) maladaptive, majority-scale behaviour or attitude. In the broader context of climate change behaviour, there are many other widespread, majority practices that persist in societies, and which experts have highlighted the need to transition away from. These include unsustainable transport choices (e.g. car use, flying), dietary choices (e.g. meat and dairy consumption), and resource use (e.g. use of energy intensive appliances, or inefficient water use) (Gardner & Stern, 2008; Ivanova et al., 2020; Wynes & Nicholas, 2017). Given these behaviours tend to have 'majority status' in developed nations, this raises a set of important fundamental questions for communication researchers. *Why do behaviours persist at a majority scale, when they have seemingly negative implications for the environment? How can communicators engage with the public most effectively, when the majority are doing something that is, arguably, maladaptive?*

This chapter investigates how people respond to criticism, given the perceived relative normality of a behaviour they are criticised for (i.e. the majority or minority status of their actions).

5.2.1 Conceptual framework

Social norms are an increasingly important research area within social and environmental psychology (Keizer & Schultz, 2013). Norms are important because they inform individuals about what kinds of behaviours are adaptive or problematic (Cialdini & Trost, 1998; Giguère et al., 2016). We often draw a distinction between injunctive norms (what you know you should do) and descriptive norms (what you see other people doing; Cialdini & Trost, 1998). When a behaviour is carried out by the majority (i.e. >50%), it can be described as being a *majority descriptive norm*, a *normative* behaviour or having *majority status*; while a minority behaviour (<50%) can be referred to as *non-normative*, or having *minority status*. While majorities and minorities can also be described in terms of power/status, group features, and counter normative position; *group size* is the most common definition applied in psychology research (Seyranian et al., 2008).

Psychology research has shown that majorities exert influence over people's behaviour via the influence of 'conformity'. Classic psychology experiments for instance, have shown that individuals are more likely to change their responses to simple questions when most other people in the room answer the questions differently (Asch, 1951; Sherif, 1936). Bigger majorities tend to exert greater conformity influence (up to a point; Asch, 1956)[1]. This research suggests that individuals generally do not wish to be outside the norm, as this is perceived to be socially threatening – even if the norm contradicts individuals' beliefs (Cialdini & Trost, 1998).. Due to this, descriptive norms and injunctive norms can sometimes be in opposition. Take for instance, littering on streets, or throwing away plastic into landfill. While most people know not to do these things, they may see others doing this and think it is ok. Descriptive norms may even shape behaviours without even existing. People can sometimes overestimate the normality of their actions (false

[1] Asch found that increasing the size of the majority beyond 3-to-1 in lab studies did not increase conformity.

consensus) and underestimate the extent to which their behaviour is normal (pluralistic ignorance). This can influence decision making and behaviour, irrespective of whether the appraisal of the norm is right or wrong (Lewandowsky et al., 2012).

In the environmental sector, social norms interventions, which tap into the influence of conformity biases, have been applied to good effect. Such interventions communicate descriptive norm information, to indicate that *the majority is doing something desirable*. For instance, one study found that hotel guests were more likely to reuse their towels after being informed that *most other guests had reused their towels* (Goldstein et al., 2007). Another study found that highlighting descriptive norm information about neighbours' energy conservation was more effective at reducing households' energy use than environmental or financial message framings (Nolan et al., 2008). However, while these interventions can be useful, they are limited in that the majority must already be doing something deemed positive or desirable for the persuasion to be effective. Corner (2011) cautions, for instance, that car use cannot be reduced by communicating descriptive social norms, as this is a majority-scale practice.

Majority practices *can* and *do* change over time. For instance, non-normative opinions can become widespread, via consistent *minority influence,* whereby a majority may take on new attitudes and behaviours via a process of 'internalisation' (Moscovici, 1974). Real-world examples of this include the women's suffrage movement, the civil rights movement and most forms of environmental activism. Top-down communications can also alter majority behaviours. Health campaigns, for instance, have effectively targeted smoking, unhealthy eating, and drink driving, in combination with policy and structural interventions (Simms, 2018). New technologies and practices can transition from having minority status to being widespread (Rogers, 2003). Furthermore, social tipping points may also occur, prompting a rapid acceleration of minority influences across broader society (Centola et al., 2018; Otto et al., 2020).

However, change to harmful majority practices sometimes can be very slow. Fossil fuel consumption has underpinned western civilisation for hundred of years; and, car use has been dominant on roads since the early 20th century in many societies, despite road deaths and respiratory illnesses each being in the top 10 causes of annual deaths globally (WHO, 2018). At a broader level, societies have also long perpetuated gender, race and class inequalities. These issues of course involve a range of social, cultural and economic complexities, nevertheless, they highlight how powerful 'hegemonies' can be maintained over time (Gramsci, in Femia, 1987).

This raises a fundamental, yet under-researched question in social psychology: *Are majorities, by their very nature, more resistant to change than minorities? Is being in the majority self-protective, allowing behaviour to be maintained more easily than if carried out by a minority?*

5.2.1.1 'Safety in numbers'? A potential divisional effect

One explanation from past research suggests that persuasive communications may be less effective when they are aimed at larger groups. *Social Impact Theory (SIT*; Latané, 1981, 1996; Latané & Wolf, 1981), posits that a "divisional effect" may occur when there are many '*targets'*.[2] The higher the numbers within the target group, the

[2] To use Latane's terminology

more the impact will be divided between them – meaning that individuals within a larger group are less likely to be persuaded than a single target. For instance, Latané (1981), report that Biblical preachers were less persuasive when audiences were larger. Similarly, Sedikides & Jackson, (1990) found that zookeepers ability to persuade visitors not to lean on railings diminished the larger the target group. SIT therefore implies that a majority would be, by nature, harder to persuade than a minority, as the influence would simply be divided across the group.

Majority/minority status may also offer protection in other ways. Majority groups may also be prone to a, so called, "Risky Shift", in which the group is more likely to take a risky course of action, as a whole (Breakwell, 2014). This suggests that being part of a sizeable in-group has a protective effect – akin to a form of 'safety in numbers'. However, it is not known whether this protection may help to buffer behavioural and attitudinal positions from external criticism. The converse may also be true for minorities. It has been shown that minority groups – such as sexual minorities, and ethnic minority groups, experience greater levels of chronic stress, leading to poor health among minority individuals (e.g. Meyer, 2003, 2010). Past research on *minority stress* has commonly focused on the role of prejudice, intergroup conflict, and socioeconomic factors. This means it is hard to disentangle from this research the exact role that the minority status itself plays as a trans-situational factor.

Following research on conformity, the divisional effect, risky shift, and (to some extent) minority stress research, it seems plausible that membership within a majority scale group offers some form of protection to individuals from communications that would otherwise be more threatening – such as criticism. In other words, being in the norm may be fundamentally protective, while being outside the majority exposes individuals to greater threat of criticism. To our knowledge, no research has addressed whether one's basic perception of being in a 'majority' (i.e. > 50%) or a 'minority' (<50%) is the pivotal factor, as opposed to simply being in a larger, or smaller group size. The distinction between group size and majority-minority status is important, given that groups of 10, as well as 100,000 people can each have minority status, relative to the behaviours of others.

This also seems plausible given past research suggests that even the most basic, abstract and meaningless distinctions between groups, such as preference for abstract art, or common colour of clothing, can establish ingroup-outgroup prejudices (Tajfel, 1996). This is known as the *minimal group paradigm*, as minimal conditions, with no apparent preconceptions involved, can give rise to the effect. It thus seems wholly possible that minimal knowledge of being positioned within a majority or a minority could be enough to create a sizeable effect on responses to criticism, even without prior identification to that group, or further knowledge of any other shared interests, or values defining that group.

5.2.1.2 The present study

Building on the past literature, this study sets out to test empirically, whether mere knowledge of one's position within a majority group (where many others share the same view) is in some way protective of one's commitment to that position. Do majorities experience less stress than minorities upon experiencing a form of threatening confrontation? Are majorities less willing to change their behaviour, compared to minorities (and/or compared to a 50/50 split?) Does this occur even with seemingly neutral activities, when all pre-conceptions and prior knowledge are

minimized (in a similar way to the minimal group paradigm)? And, can such responses be measured both physiologically and by self-report?

Given that past research on majority/minority influence has tended to address manipulations of *source type* (i.e. whether the communicator represents the majority or minority), rather than the *recipient's position* (Martin & Hewstone, 2008), the present research will focus explicitly on manipulating the *recipients' position*. Unlike previous work, the study will utilise a neutral communications source (i.e. with no group affiliation to majority or minority).

This chapter thus presents a carefully controlled lab study designed to test the notions that *knowledge of one's position within a majority or minority of others may influence one's ability to cope with threatening confrontation about a behaviour shared with other group members.* To test this, we aimed to strip away all potentially confounding factors – leaving a highly controlled lab study, in which only the majority-minority distinction remains. Majority-minority status was primed in relation to an abstract task, which involves sorting cards *numerically* or by *suits*. Participants were then criticised for their choice, during the card sorting. To test responses thoroughly, the lab study utilized both implicit (physiological) and explicit (self-reported) measures of stress and stimulation.

Given that we wish to test how majorities versus minorities respond, the form of communication intervention must be consistent. Environmental campaigning often utilizes assertive communications styles (Kronrod et al., 2012), and some research finds admonishment to be an effective technique in altering environmental behaviour (Swim & Bloodhart, 2013). We will therefore replicate this in the lab by consistently employing criticism as the form of persuasive communication. This relatively threatening form of persuasive communication allows us to test at a fundamental level whether threats posed by communication are perceived less strongly by majorities, relative to minorities or a control condition.

5.2.2 Research question:

In summary, the research question of focus is:

***RQ**: With all possible preconceptions removed, is minimal-level information that one's behaviour falls within a descriptive norm majority (>50% of others) or a minority (<50% of others) enough to induce significant differences in the way individuals respond to criticism about current behaviour (in terms of stress, and behaviour change)?*

5.2.3 Hypotheses

The specific hypotheses that will be tested are:

(H1a) Participants in the majority group will experience less stress and stimulation due to confrontation - compared with the control and minority, while (H1b) the minority group will experience greater stress and stimulation.

(H2a) Participants in the majority group will be least willing to change their choice, following the confrontation – while (H2b) participants in the minority will be most willing.

5.3 Methods

5.3.1 Ethical approval

Ethical approval for this study was granted by the psychology ethics committee (Ref: 16-065). Before participating in the study, participants were asked to read over an information sheet, and provide voluntary consent. At the end of the study, participants were thoroughly debriefed, and given an opportunity to withdraw data.

5.3.2 Recruitment

Participants were recruited via advertisements, posters and leafletting at the university of Bath; via adverts placed online (e.g. online noticeboards, local social media pages, and callforparticipants.com); via the Psychology Community Research Panel, and via word of mouth. Efforts were made to recruit not just a student sample, but a broader range of ages and demographics. Participants were offered the chance to win a £50 voucher for their participation.

5.3.3 Pilot

Substantial piloting was carried out ahead of data collection. Experimental design and trialling of the physiological equipment (as detailed below) were carried out with the help of a research assistant. Piloting of the experiment with 3x postgraduate students was carried out to test the procedure and take feedback. Following feedback, the study design, procedure and communication intervention were refined and developed further.

5.3.4 Participants

A power analysis was conducted using the *G*Power* application (Faul et al., 2007)[3] to calculate the minimum sample size required for this study. The sample size required to find large effect sizes for 3x condition ANOVA, with .80 power, and a confidence level of $\alpha = 0.05$, was N=63. This aligned with recommendations in Cohen (1992). This was treated as a conservative estimate, and efforts were made to collect a larger sample size, with ideally equal numbers in each condition. Following data collection, two participants were excluded from the analysis, due to completing measures at the incorrect time in the procedure (i.e. skipping to final questions too soon). The final sample (N= 92), had the following numbers in the three conditions: control (n= 30) majority (n= 31) and minority (n= 31). This sample size gave power of 0.932 to detect large effect sizes of .40 and above at the .05 confidence threshold; and, the sample size was sensitive enough to detect effect sizes of 0.329 and above, at .80 power. More female participants (62%) took part in the study. The average age was 26.9 and the sample was roughly half UK nationals and half from other nations (see *Table 5.3.1).*

Table 5.3:1 *- Key descriptive characteristics of the current, overall sample.*

Variable	Sample characteristics
Age	M= 26.90 (SD= 9.61; Min= 17, Max= 63)
Gender	Female (62%), Male (38%).
Nationality	UK (51.1%), Non-UK (48.9%)

All percentages reported are 'valid percent', excluding missing data, and thus may not sum to 100%.

[3] See also: https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower.html

5.3.5 Measures

To measure responses to the confrontation, we aimed to find very sensitive and well-established measures that could reasonably pick up on differences between the conditions. Literature on stress and emotion was assessed (e.g. Hjortskov et al., 2004; Lazarus, 2006) and advice was taken from an expert in clinical psychology, who suggested a combination of physiological and 'state' based self-report measures, given the needs of the study design and the hypotheses (Gregory, 2016: personal correspondence). A variety of explicit scales of state anxiety and mood were identified as being relevant, as well as physiological measures. The selected measures are described below.

5.3.5.1 Physiological (implicit) measures

The primary requirement of physiological measurement was to ensure that any stress and stimulation produced by confrontation was recorded through reliable, sensitive and robust methods. After reviewing psychological studies where implicit measures of stress and stimulation were taken at different time points (e.g. Hjortskov et al., 2004; Thayer et al., 2012), measures of Heart Rate Variability (HRV) and Electrodermal Activity (EDA) were selected for this study. HRV is considered to be one of the most sensitive and reliable measures of acute stress (Malik et al., 1996), and EDA is a very sensitive measure of general stimulation (Braithwaite et al., 2012). HRV and EDA measures also have practical benefits in that they are non-invasive, allowing data collection to continue whilst participants carry out other tasks; and once recording, require minimal intervention from experimenters. Both EDA and HRV could also be measured simultaneously and run during self-report measures, allowing greater triangulation of results. Other physiological measures used in psychology research, such as blood pressure (e.g. Hjortskov et al., 2004; Scheepers & Ellemers, 2005) and cortisol measurements (e.g. Dickerson & Kemeny, 2004), were either not as reliable for measuring immediate temporary stress, or were less practical for repeating with many participants.

All physiological data was recorded with the *BioPac MP150*, with ECG100C and GSR100C modules, and recorded in *AcqKnowledge 4.1.0* (*BioPac Systems, UK – biopac.com).* Based on guidance (BIOPAC-Systems, 2016; Braithwaite et al., 2012), ahead of the study, the HRV and EDA equipment was piloted to check the equipment's sensitivity to changes in physiological exertion (e.g. holding one's breath, or clenching one's fist), as well as pilot criticism and stress inducing stimuli (i.e. a short scary video). The piloting showed at face value that the measures were working, and were sensitive to the types of responses of interest. Further details of the HRV and EDA measurement are given below, while details of their respective analyses are given in the analysis section.

5.3.5.1.1 Heart rate variability (HRV)

Heart rate variability is the observed variation in beat-to-beat intervals of heart beats. It is derived from the recording of an electrocardiogram (ECG), and relates to regulation in the autonomous nervous system, specifically vagal outflow of the heart (Malik et al., 1996). Heart rate during rest and activity is determined by the interplay between the sympathetic nervous system ("fight or flight" responses to threats) and parasympathetic nervous system ("feed and breed" - stimulation of activities when the body is at rest, e.g. sex, digestion, salivation). Simply speaking, *greater* variability in heart rate is associated with *lower* levels of stress.

In several papers (e.g. Thayer & Brosschot, 2005; Thayer & Lane, 2000, 2009) it has been proposed that HRV may provide an ideal index for measurement of adaptive responses to physiological, behavioural, affective, cognitive, social, and environmental demands. HRV thus forms a quantifiable, standardized proxy measurement for a system that functions both to continuously assess the environment for signs of threats, and to prepare people for appropriate action (Ibid.). This makes HRV particularly suited to the focus on threats and coping within the thesis.

HRV can be broken down into time and frequency domains. The latter is more commonly analysed in studies where HRV is analysed over short time periods (e.g. 5 minutes), whereas time domain analyses are typically carried out over much longer periods (e.g. 24hrs) (Malik et al., 1996). Within the frequency domain, High Frequency (HF) HRV represents primarily parasympathetic activity, while lower frequencies (below about 0.15 Hz) have a mixture of parasympathetic and sympathetic autonomic influences. The HF domain is considered to be the most reliable band for making comparisons of HRV, given that influences on the low and very low frequency bands are complex and currently poorly understood (Malik et al., 1996). HF HRV has reliably been shown to alter in response to emotional strain, anxiety, and time pressure, to name just a few examples (e.g. Hjortskov et al., 2004; Palanisamy et al., 2013; Thayer et al., 2012). Therefore, the HF band forms a suitable focus for analysis in this study. Please note, HF activity is anticipated to be *reduced* under conditions of stress.

An electrocardiogram was sampled at 1000Hz[4], following manufacturer guidelines (BIOPAC-Systems, 2016). Participants were instructed to clean and dry the skin, before electrodes were attached. The VIn+ electrode was attached at the left ankle, and Vin- at the upper right neck. This allowed the participant to have one hand free for the duration of the experiment, whilst conforming with an 'Eindhoven Triangle' set up advised for clear ECG recording (BIOPAC-Systems, 2016; Malik et al., 1996). Electrodes were taped to the skin, and a loop was added to the wire near the electrode, to reduce unwanted interferences in the recording from movement. The participant's dominant hand was left free. Signals were checked before commencing the recordings with each participant.

5.3.5.1.2 Electrodermal activity (EDA)

Electrodermal activity, also known as galvanic skin response (GSR), is a measure of arousal, or stimulation, relating to continuous changes in the electrical characteristics of the skin (Braithwaite et al., 2012). Sympathetic activity exists in a relationship with emotional arousal, resulting in changes to the skins conductivity. If the sympathetic branch of the autonomic nervous system is aroused, sweat gland activity generally increases, which in turn increases skin conductance. EDA measurements utilise transducer clips placed in the skin, which measure levels of skin conductance, typically in units of microsiemens (µS), through application of a very small electrical current (not felt by the subject) (Braithwaite et al., 2012).

EDA is ideal for studying implicit responses to criticism, given that EDA acts as *"an objective index of emotional states",* and can be used *"to examine implicit emotional*

[4] Additional MP Settings were selected according to manufacturer guidelines (Mode: NORM; LPN 35Hz: On; HP Filter: On) (See: BIOPAC-Systems, 2016).

responses that may occur without conscious awareness" including threat responses (Braithwaite *et al.* 2012: 3). EDA has therefore been utilised in varied psychological studies to understand responses to stress-related stimuli (Critchley & Nagai, 2013). However, while a useful measure of sympathetic activity, EDA is more limited than HRV in the sense that, while it can signify changes in arousal, it is not able to distinguish which specific emotion is being elicited. Due to this, it is recommended to pair EDA with explicit measures of affect, mood or emotional state, allowing triangulation between results (Braithwaite et al., 2012). This approach has been taken in the present study.

EDA measurement can provide several different outputs. The EDA complex includes both background *tonic* (i.e. skin conductance level - SCL) and rapid *phasic* components (i.e. skin conductance responses - SCRs) resulting from sympathetic activity (Braithwaite *et al.* 2012). SCL relates to general, slower changes in the signal; while SCRs refer to faster changing elements (Braithwaite et al., 2012). Given that SCL generates a constantly changing baseline and can differ markedly between individuals, it was not a suitable measure for the purposes of this study. Following discussions with the equipment manufacturer, the number of SCRs, compared between pre and post time segments, was identified as the most suitable measure of EDA, for the purposes of this study (BioPac, 2018: personal correspondence). By taking measurements at different timepoints, and utilising a mixed experimental design, pre-to-post SCR events reflect *relative changes in stimulation for each individual* – thus avoiding issues relating to individual differences in SCL between participants. Relative increases in the number of SCRs was thus anticipated to indicate greater stimulation from criticism.

For the present study, EDA was measured with an 'exosomatic' method, using the GSR100C module, and sampled in *Direct Current* (DC).[5] This is the most common method in psychophysiology studies (Boucsein et al., 2012). Saline gel was added to the transducer clips before attaching to the first and third finger of the participant's non dominant hand[6] (Braithwaite et al., 2012). A cushion was provided for the participants to rest their non-dominant hand during the procedure, and participants were briefed about the need to avoid significant or sudden movements throughout the procedure. A 5-minute baseline period at the start of the procedure allowed saline gel to be absorbed, as is typically recommended (Braithwaite et al., 2012). The clips were cleaned between participants, and at the end of each day, following best practice guidance (Ibid.)

5.3.5.2 Explicit measures

Self-report measures pre and post confrontation were captured on a laptop,[7] using the Qualtrics survey platform. This survey was also designed to include prompts for participants to take certain actions (see procedure).

While designing this study, it was anticipated that a large effect of confrontation would reasonably be picked up on several cognitive or affective measurements, such as self-esteem, negative affect and state mood scales. However, given the continued

[5] MP settings were selected according to manufacturer guidelines (GAIN: 5 μmho/V, Low Pass: 10Hz, DC settings adopted).
[6] As different parts of the body can produce different skin conductance readings, all participants had transducers attached to their non-dominant hand for the duration of the study.
[7] The laptop was unplugged to avoid interference with EDA measurement.

interest in threat appraisals in this thesis – a reliable, well validated, and comprehensive measure of anxiety was particularly appropriate. Therefore, the key self-report measurement adopted was the *State Anxiety* scale*,* from the *State-Trait Anxiety Inventory* (Spielberger et al., 1983). This 20-item scale offers a comprehensive assessment of momentary anxiety, with good internal consistency, and has been utilised in many stress-related studies (APA, 2011). The scale includes both items of positive valence (e.g. "I feel calm", "I feel secure") and those of negative valence ("I feel tense", I feel frightened"), which are measured on a 4-point Likert scale (1= Not at all, 4= very much so). For analysis, items of negative valence were reverse coded, before a mean score was taken. A higher average score thus represented greater calmness, and lower state anxiety.

Behavioural intentions were measured following confrontation, via one item, which asked: *"If I had the option to complete the card task again, I would choose to sort by [3 x choice options: suits / numbers / don't know or unsure]".* Based on participant's actual card sorting behaviour, a dichotomous variable of willingness to change was created, with 'change' or 'no change' as values. Given intention to *change* behaviour was of primary interest, those who answered "don't know/unsure", were coded as 'no change'.

Several other measures were taken pre and post-test. This included measures of self-esteem, state mood, task difficulty, values-orientations, trait reactance and demographics (age and gender). However, these were not analysed as they were not of primary interest for hypothesis testing. They were also included, in part, to ensure participants had consistent behaviour during periods in the protocol where physiological measures would be taken (see below).

5.3.5.3 Other measures

At the end of the procedure, three questions were asked of participants verbally, acting as suspicion checks. Participants were asked: "can you describe what you have been doing in this study?", "in your own words, what was this study about?" and, "why did you choose to sort the cards in that way?". If participants raised any suspicions about being deceived during these questions, then a note would be taken by the experimenter. Participants were categorized as 'suspicious', 'maybe suspicious' and 'not suspicious'. After data collection, it was decided that these measures were not operationalized to a sufficient standard, given this required the experimenter to subjectively interpret suspicion levels, and participant responses appeared to be influenced by 'hindsight bias' (see: Roese & Vohs, 2012).

Given extremes or sudden changes in temperature can affect physiological measurements, the same lab was used throughout the study, and temperature was recorded pre and post-test. No causes for concern were observed (M= 21.6^{o}C, SD= 1.1^{o}C).

5.3.6 Study design and procedure

This lab study involved a reasonably complex and lengthy (45-60min) procedure. However, it's important to note that, while complex, this procedure was designed to facilitate the simple aims of the study - to test potential majority, minority and control group differences to an unexpected criticism, at a very minimal, abstract level.

The experiment involved a 3 x 2 mixed design, with one independent samples factor of norm status, with the levels: majority, minority and control; and one repeated factor

of time, with the levels: pre and post criticism. This is summarised, with participant numbers in *Table 5.3.2*.

Table 5.3:2 *- Table summarising the study design with participant numbers indicated in cells*

		Time	
		Pre	**Post**
Norm status	**Majority**	31	31
	Minority	31	31
	Control	30	30

The study was based around an abstract card sorting task, which participants were then criticised about. The study was set up to ensure:

i) Participants chose a card sorting technique (suits vs. numbers), blind to any information about how normative (i.e. majority, minority) their specific choice of sorting was.

ii) The person who criticised participants was not present while the participants decided how they will sort the cards. This meant the participant could be criticised during the card sorting, rather than while making their choice (i.e. similar to real world behavioural criticism).

iii) Proper use of the physiological equipment was possible (i.e. set up time, minimal disruption to the data from movement, and comparable 5-minute recordings pre and post criticism).

A flowchart is presented in *Figure 5.3.1* below, which details the main aspects of the procedure in nine steps. Each of these nine steps are then described below, in further detail.

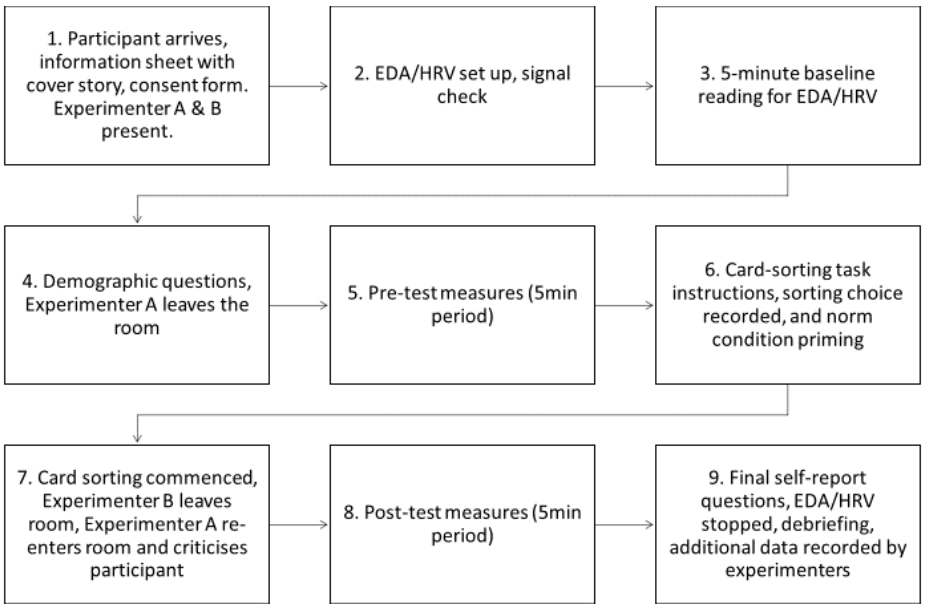


Figure 5.3:1 *- A flowchart detailing the key stages of the lab study procedure*

1. Participants were invited into the lab under the pretence that they were entering a study on the topic of 'Behavioural Economics' – a cover story used to deceive participants. Upon entering the lab, participants read over an information sheet, and provided consent to participate.

2. HRV and EDA equipment was set up with participants as described above (see also *Figure 5.3.2*). A signal check was carried out to ensure clear physiological readings.

Figure 5.3:2 *- Electrodes were attached at right hand side of the neck (top image) and to the left ankle (bottom image). Images: Niall McLoughlin.*

3. A 5-minute baseline reading was then taken – which also allowed the saline gel to be absorbed into the skin sufficiently. This also controlled for any prior physical exertion from participants' journey to the lab.

4. Following this 5minute period, a time marker was placed in AcqKnowledge noting the start of the procedure, and participants were instructed to begin answering self-report questions on the laptop. Participants answered demographic questions. Experimenter A left the room at this point, explaining to the participants that they would be left under the supervision of Experimenter B.

5. Upon completion of the demographic questions, a computer message prompted participants to notify Experimenter B they had completed the section. At this point, Experimenter B asked participants to continue to the next section ('pre-test measures'), and simultaneously added a time marker to the physiological data. Participants were advised to await further instructions upon completing this section of questions. After a period of 5minutes (300secs), Experimenter B added another time marker, signifying the end of the 'pre-test measures'.

6. Following this, verbal instructions were given to participants relating to a card sorting task (see *Figure 5.3.3*, and for dialogue, see *Table 5.3.3*). For this task, participants were asked to sort a shuffled deck of 52 standard playing cards, numerically or by suits. This was performed physically, onto an A2 sheet of card, which had been customized for this task. The A2 sheet of card was visually split down the middle, with one half titled 'suits' and the other 'numerical'. In the suits section, were four card-sized boxes, and on the numerical size were thirteen card-sized boxes, providing space for the card sorting. Before commencing the card sort, participants were asked by Experimenter B to state verbally which method they had decided to sort the cards. Once participants committed to their choice – numerical or suits – Experimenter B presented one of three randomly selected booklets to the participant.[8] These booklets contained pre-manipulated information, which was used to assign participants to one of three conditions – majority, minority or control. Given every participant was led to believe they were the 61st participant to participate in the study, 60 x tallies already existed in each booklet on the first page. The tallies were structured to signify *how many other participants had chosen to sort the cards by suits vs. numerically*, before the current participant. This information was thus manipulated to suggest either:
   - Suits= 91% vs. Numerical= 9%
   - Numerical= 91% vs. Suits= 9%
   - Or, a 50/50 split between Suits vs. Numerical

   This information was designed to very clearly signal to participants that they were part of a majority, minority or even split of others. Given that Social Impact Theory (Latané & Wolf, 1981; Sedikides & Jackson, 1990) suggests that persuasion will be more readily divided the larger the 'target' group, we opted for a very distinct (yet believable looking) majority and minority split. To

[8] To randomise booklet selection, a random number between 1-3 was generated using the website 'random.org'.

ensure participants noticed this information, they were asked to add their own tally to the booklet. The presentation of the booklet was carried out after participants had committed to a card sorting method, so participants "fell into" the norm (replicating real-world situations). This also prevented any influence of conformity on the choice.

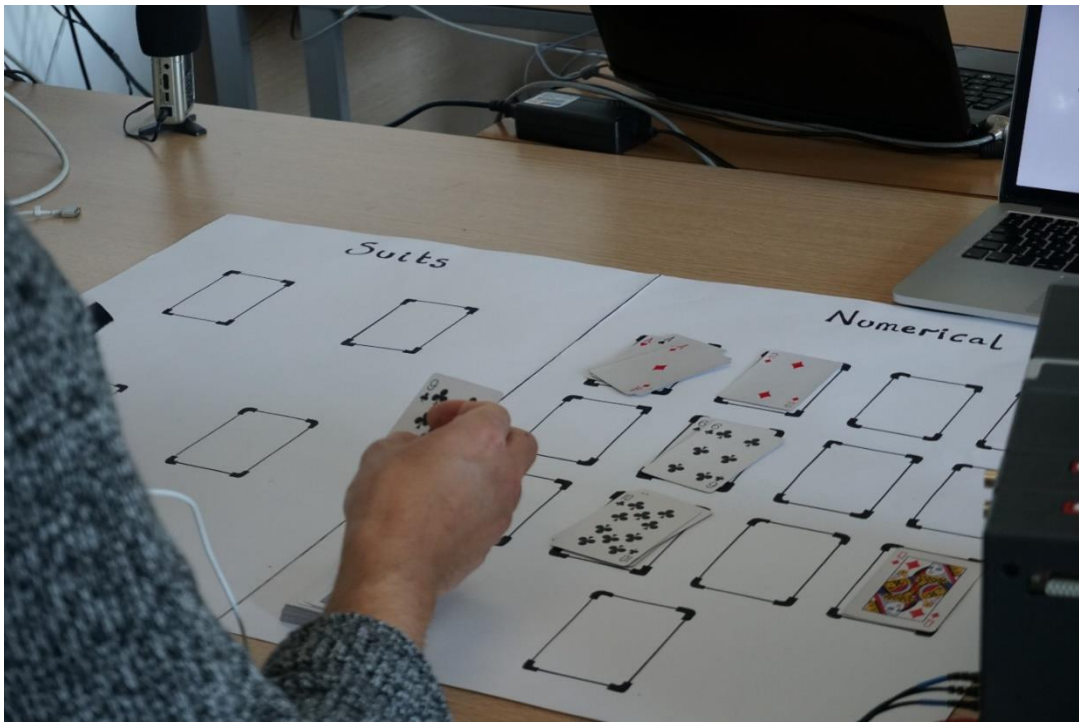


Figure 5.3:3 *- Example of a participant carrying out the card sorting task, ordering the cards on the 'numerical' portion of the card sorting sheet [Image: Niall McLoughlin]*

7. Once participants had given their card sorting tally, the booklet was closed (to ensure Experimenter A would remain blind to this information). At this point, Experimenter B would instruct the participant to begin sorting the cards. They would then add an event marker to the physiological data, start a timer, and leave the room. After exchanging of the timer outside of the room, Experimenter A then re-entered the room, and criticised the participant about their card sorting. The time between participants starting the task and the criticism was kept consistent at 2 minutes. The dialogue relating to the task and confrontation is presented below in *Table 5.3.3*.

Table 5.3:3 *- Procedure relating specifically to the card sorting task and moment of confrontation.*

Experimenter B*: "Ok, so we're going to move on to the card task now. Again its very important you are still as possible for this, or it will affect the data. So, you must only move your dominant hand. You have a standard 52-deck of cards in front of you and you have a free choice to sort them either by suits, or by numbers - placing them into the panels on one side of the sheet. So, how are you going to sort the cards?* ***Participant:*** *[gives choice for card sorting: suits or numerical]*

***Experimenter B**: [presenting randomly selected booklet to participant] "Ok – please add your tally to this book for how you plan to sort the cards".*

***Participant**: [adds tally to booklet]*

***Experimenter B**: [Closes the booklet] "Now, when I say go you can start the card task" … "go", [adds an event marker to the physiological data called "card sorting task start" and starts timer. After 30sec, leaves the room, and hands timer to Experimenter A, who is waiting outside].*

***Experimenter A:** [after 1min 30secs has passed on the timer, re-enters the lab and walks over to the computer which is collecting the physiological data]. Says: "*just got to check something on the computer". [At precisely 2 mins on the timer, adds an event marker in the physiological data representing the moment of confrontation]. Confronts the participant directly: *"Ah! that's a shame! I would <u>not</u> have done it like that"* [pauses, then continues] "…Ok - you can stop now, we have enough data on this". (If the participant responded verbally at this point, Experimenter A would say: "We're going to move on now"). Says: "When I say go, you can start the next section on the laptop". [Adds an event marker signalling 'post-test measures start'].

8. After the criticism, participants were instructed to continue answering questions. A timer was started, and an event marker was added to the data to indicate ('post-test start'). The questions the participant answered during this section were repeats of the pre-test measures. After 5-minutes, Experimenter A gave the signal to participants to move onto the final section, whilst adding an event marker, called 'post-test measures end'.

9. Following this, participants answered the final questions on the laptop. Once participants completed the questions, suspicion checks were carried out. All recordings were then stopped, participants were thoroughly debriefed, and electrodes were removed. Once the participants had left the room, the experimenters recorded information about the card choice, participants' suspicion levels, and room temperature. After each participant, the three booklets relating to the conditions were edited, so only 60 tallies were shown to the next participant.

5.4 Analysis

5.4.1 Heart rate variability

ECG signals were band pass filtered (0.5 to 35Hz, at 8000 coefficients) (BIOPAC-Systems, 2016; BioPac, 2018). Raw tachograms were generated, and every heartbeat across the 2x 300 second regions was visually inspected for artifacts, for each of the 92 participants. This process is necessary to detect artifacts that may be caused by movement, interference, missed or ectopic heartbeats, which can cause errors in HRV calculations. Artifacts in as little as 2% of the ECG data can result in unwanted biases in HRV (BIOPAC-Systems, 2016; Malik et al., 1996). Thus. for this study, a total of 920 mins (15.3 hours) worth of data had to be manually inspected for potential artifact corrections. Artifacts were identified by the presence of an unusual R–R interval, not within the expected physiological range (e.g., a R–R interval of 2 seconds when surrounding tachogram data ranged from .7 to .9

seconds; as suggested by Beevers et al., 2011; Malik et al., 1996). Artifacts identified in the tachogram were then confirmed by examination of the ECG. Identified artifacts were eliminated by adjusting the value of the peak to within the tachogram threshold or by eliminating the artifact completely (BIOPAC-Systems, 2016). Missed beats were corrected through one of two methods, based on recommendations by Berntson et al., (1997): (a) splitting erroneously long beats into separate R–R intervals, or, (b) interpolating the missing R-waves from the surrounding beats. A log of artifacts and corrections was kept.

Tachograms for the 300 second regions, pre and post confrontation, were then exported to Kubios HRV (www.kubios.com) for frequency domain analysis, and followed established approaches (Malik et al., 1996). Power spectral analysis was computed using fast Fourier transformation (frequency spectrum: 0.04 to 0.5 Hz). Power in the high frequency range (0.15–0.4 Hz) was computed and recorded in units of milliseconds squared. HF data was then matched with participant survey responses for further analysis (see below).

5.4.2 Electrodermal activity

Analysis of EDA data was carried out in AcqKnowledge 4.1 initially. Data was visually inspected for artifacts or interference (e.g. resulting from movement during the procedure). Data with noise was high pass filtered, and visually inspected and corrected, based on recommendations provided by manufacturer experts (BioPac, 2018). The phasic EDA was derived from the tonic signal. SCRs were located across the data, and number of SCRs were recorded from the 5-minute segments, pre and post confrontation. SCR threshold was set at 0.03µS (with a range of 0.01µS - 0.03µS), with a rejection rate of 10% (Braithwaite et al., 2012b). Participants who naturally had an extremely low/unresponsive EDA, or had high amounts of movement artifacts were recorded as missing data, and were subsequently excluded from analysis on a case-by-case basis.

5.4.3 Statistical analysis

All further statistical analysis was carried out in IBM SPSS 25. The study was designed so that differences between groups could be assessed (i.e. majority vs. minority vs. control), as well as interactions between norm condition and time (i.e. pre and post). Thus, for *HRV*, *EDA* and *state anxiety*, mixed ANOVAs were employed to assess potential differences between conditions and potential interactions. For potential influences of norm status on *behavioural intentions*, given this was a categorical measurement (i.e. ‘change’ vs. ‘no change’), a Chi-Square test was employed.

5.5 Results

5.5.1 Willingness to change behaviour

A Chi-Square test was carried out to test whether there was an association between willingness to change card sorting choice (following the admonishment) and condition type. All expected cell counts were greater than five. 92 participants were assigned to three group conditions (31 majority, 31 minority, and 30 control). The analysis showed that the majority group appeared to be more willing to change the choice of their card sorting, with 32.3% (expected count= 7.1, observed count= 10) in this condition saying they would change their choice, compared with 19.4% in the minority (observed= 6, expected= 7.1), and 16.7% in the control (observed= 5, expected= 6.8). The proportions of participants in each of the three conditions who expressed willingness to change behaviour, post-criticism, is illustrated in *Figure*

5.5.1 below. The chi-square test showed that the three independent groups were not significantly different, $X^2(2, 92)=2.424$, $p= .298$. Therefore, the null hypothesis could not be rejected.

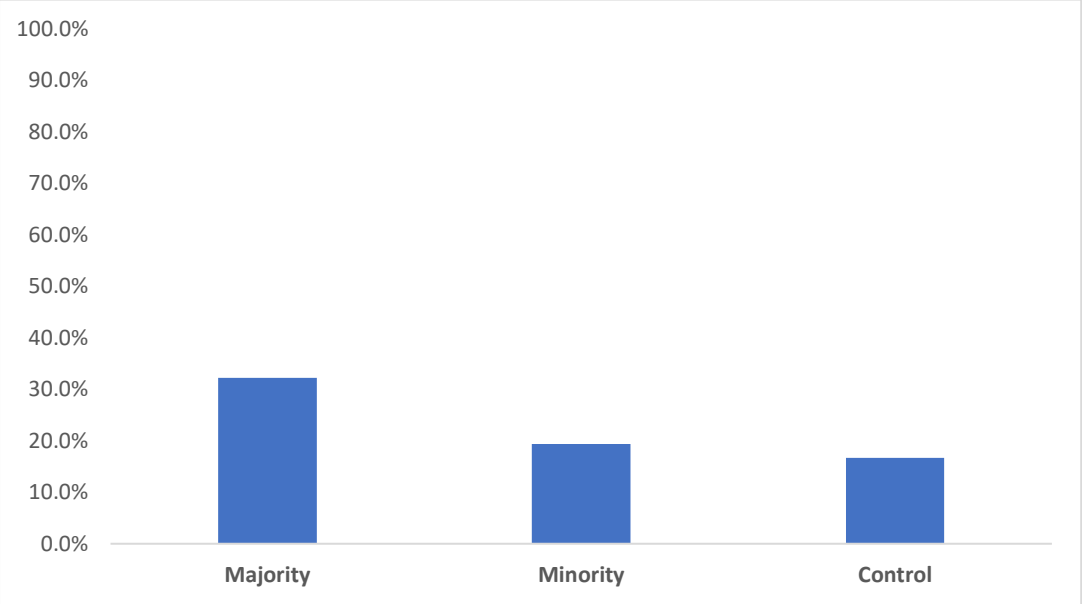


Figure 5.5:1 *- Proportion of participants who were willing to change card sorting choice, following criticism, by condition type.*

5.5.2 Mixed ANOVA on heart rate variability (HF Power)

A mixed ANOVA was performed to assess if there was an interaction between time and experimental condition on HF Power scores.

HF Power ($msec^2$) was found to be non-normally distributed, as assessed by a Shapiro-Wilk's test (p <.05) in all cells of the design. Several outliers also existed in the data, as assessed by inspection of box-plots for values greater than 1.5 box-lengths from the edge of the box. Therefore, a log of HF Power was used instead, from which three outliers were removed, following further inspection of box plots. This resulted in the following group distribution: majority (n=30), minority (n=29), control (n=30). The logged HF data was normally distributed, as observed via inspection of histograms, normal Q-Q plots and Shapiro-Wilk's test scores (HF pre, $p= .875$; HF post $p= .977$). There was homogeneity of variances, as assessed by Levene's test of homogeneity of variance (p > .05). There was homogeneity of covariances, as assessed by Box's test of equality of covariance matrices ($p= .543$).

There was no statistically significant interaction between the intervention and time on HF Power, $F(2, 86)= 0.23$, $p= .798$, partial $\eta2= .005$. The main effect of time showed a statistically significant difference in HF Power at the different time points, $F(1, 86)= 9.14$, $p= .003$, partial $\eta2= .096$. There was no main effect of condition type on HF Power, $F(2, 86)= .329$, $p= .721$, partial $\eta2= .008$. These results are illustrated in *Figure 5.5.2.*

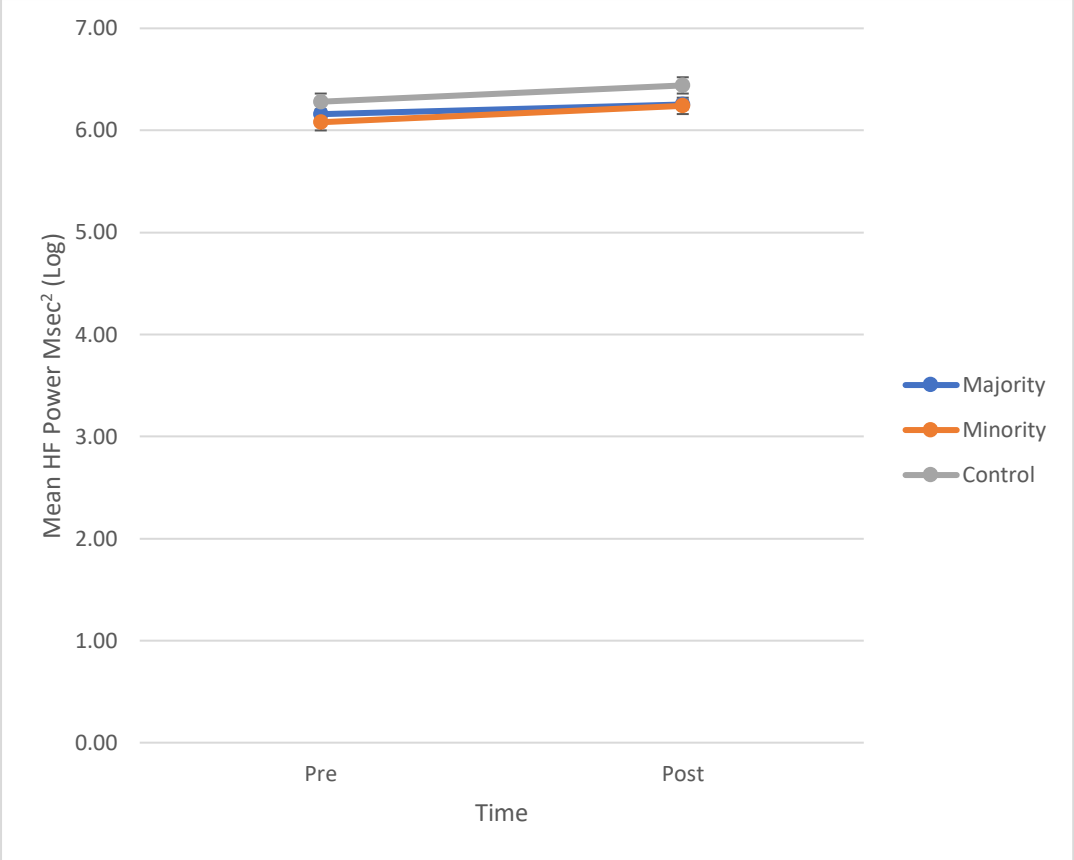


Figure 5.5:2 *- Line chart showing mean HF Power by condition and time.*

5.5.3 Mixed ANOVA on electrodermal activity

Using number of skin conductance response (SCR) 'event cycles' as the pre and post dependent variables, a mixed ANOVA was performed to assess if there was an interaction between time and experimental condition on electrodermal activity. For this analysis, 7 participants were excluded from the analysis at the outset, due to either missing data as a result of problems with the EDA measurement, or having no measurable EDA.

Number of SCR event cycles pre and post were non-normally distributed, as observed via histograms, normal Q-Q plots, and a Shapiro-Wilk's test ($p < .05$ in all cells except for 'pre-test majority' where $p = .057$). As data was moderately positively-skewed, data was transformed using a square root calculation. The transformed data was found to be normally distributed in all cells of the design, as observed via inspection of histograms, normal Q-Q plots and Shapiro-Wilk's test (which ranged from $p = .05$ – $p = .626$). No outliers were observed, via inspection of box-plots for values greater than 1.5 box-lengths from the edge of the box.

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variance ($p > .05$). There was homogeneity of covariances, as assessed by Box's test of equality of covariance matrices ($p = .922$). There was no statistically significant interaction between the intervention and time on SCR event cycles, $F(2, 83) = .487$, $p = .616$, partial $\eta 2 = .012$. The main effect of time showed there was no statistically significant difference in mean SCR event cycles, pre-to-post test, $F(1, 83) = .006$, $p = .940$, partial $\eta 2 < .000$. The main effect of group showed that there was no statistically

significant difference in SCR event cycles between conditions F(2, 83)= .006, *p*= .994, partial η2 <.000. These results are illustrated in *Figure 5.5.3*.

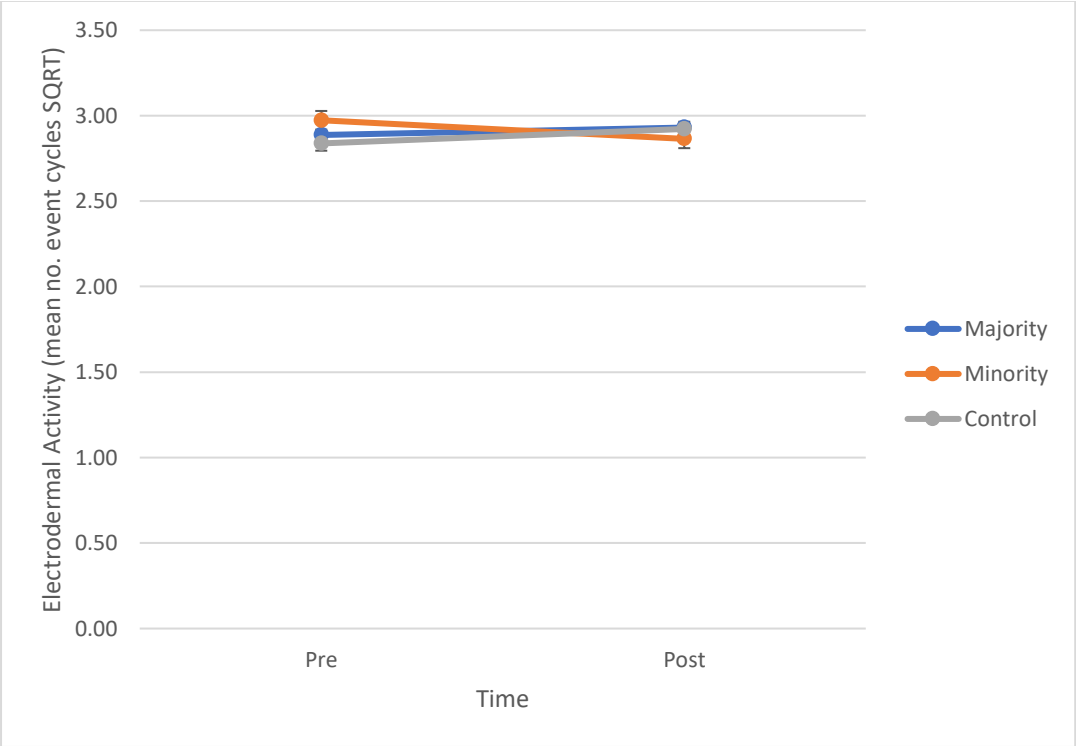


Figure 5.5:3 *- Line chart showing mean number of event cycles (transformed by square root) by condition and time.*

5.5.4 Mixed ANOVA on state anxiety

A mixed ANOVA was performed to assess if there was an interaction between time and experimental condition on self-reported state anxiety scores. The scores were normally distributed, as observed via inspection of histograms, normal Q-Q plots and a Shapiro-Wilk's test (which ranged from *p*= .069 – *p*= .808). Three outliers were found via inspection of boxplots for values greater than 1.5 box-lengths from the edge of the box. These cases were not removed as values were within the expected scale range.

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variance (*p* > .05). There was homogeneity of covariances, as assessed by Box's test of equality of covariance matrices (*p*= .782). There was no statistically significant interaction between the intervention and time on state anxiety, F(2, 89)=.197, *p*= .821, partial η2= .004. The main effect of time showed a statistically significant difference in mean state anxiety pre-to-post test, F(1, 89)= .13.87, p <.001, partial η2= .135. The main effect of group showed that there was no statistically significant difference in state anxiety between conditions F(2, 89)= .188, *p*= .829, partial η2= .004. These results are illustrated in *Figure 5.5.4*.

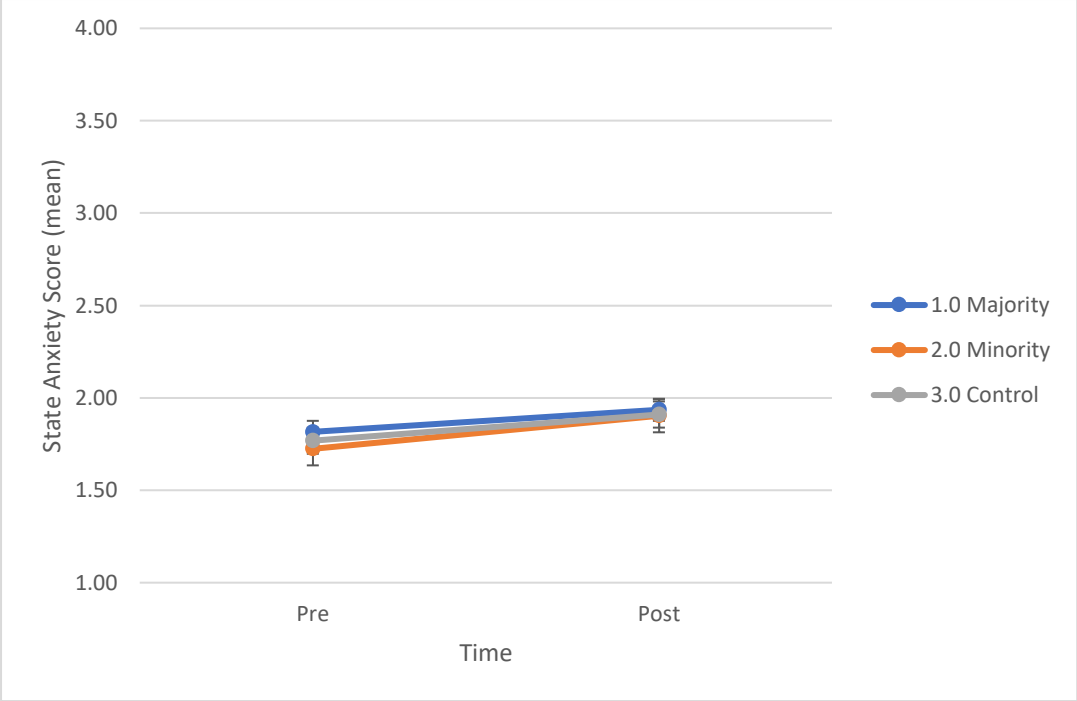


Figure 5.5:4 *- Line chart showing mean state anxiety scores by condition and time.*

5.6 Discussion

This work suggests that peoples' responses to threatening communication, in terms of their stress and willingness to change their behaviour, is not influenced at an abstract level, by normative status. In other words, at a minimal level, peoples' position within a majority or minority did not influence their response to criticism. The experimental procedure did not yield any significant differences between majority, minority and control in terms of state anxiety, electrodermal activity, or heart rate variability. There were not any significant interactions between time (pre-to-post) and condition on any of the outcome variables measured either. The hypotheses did not stand up in testing. Given the sufficient sample size achieved, the carefully controlled and executed design, and the range of explicit and implicit measures employed, the results clearly suggest that majorities are *not* self-protective at an abstract level. (This is at least the case with regards to large effect sizes).

Table 5.6:1 *- Summary of hypothesis testing*

Hypotheses	**Outcome**
(H1a) Participants in the majority group will experience less stress and stimulation due to confrontation - compared with the control and minority (H1b) the minority group will experience greater stress and stimulation.	Not supported Not supported
(H2a) Participants in the majority group will be least willing to change their choice, following the confrontation (H2b) participants in the minority will be most willing.	Not supported – although non-significant, the majority appeared to be more willing than the other conditions to change choice. Not supported

These findings contrast with research discussed in the introduction of this chapter. Notably, the results do not support Latané & Wolf's (1981) idea of a 'divisional effect' at a minimal level, whereby the threat and persuasive power of criticism would be divided amongst members of a majority group. The results suggest such an effect did not exist, at least when all possible preconceptions about behaviour have been removed, and the task is abstract. The research also suggests if people are criticised when positioned in a minority group, this is no more stressful than being criticised when in a majority or evenly split group. This contrasts somewhat with theory around the influence of conformity (e.g. Cialdini & Trost, 1998; Sherif, 1936). Such work suggests that being in the minority is generally undesirable and threatening, while being in a majority offers security and protection. This also contrasts somewhat with minority stress research (e.g. Meyer, 2003, 2010), which highlights that minority groups often experience greater stress day to day. However, it should be noted that the present study was conducted as a highly abstract level, focusing on minority in terms of relative group size, rather than focusing on minority groups defined by other characteristics (e.g. race, or shared beliefs).

The non-significant findings of the current study also contrasts with some research concerning group-based perceptions. The idea that there are no differences between majority, minority and control at this abstract level goes against evidence concerning the minimal group paradigm (Diehl, 1990; Tajfel, 1996). The current work did not support the idea that any group membership, no matter how abstract or minimal, can result in differing perceptions. However, it must be noted that work on the minimal group paradigm primarily deals with intergroup conflicts, with prejudice and in-group favouritism as typical outcomes of interest. Instead, this study was more about processing of confrontation dealt by a seemingly neutral experimenter (i.e. with seemingly no identification with the out-group).

One interesting finding, that was suggestive of an effect of norm status, concerned group differences in willingness to change behaviour, post-criticism. While the association between norm condition and willingness to change choice was *not* significant, a relatively greater proportion of the majority group stated they would sort the cards differently, given a second attempt. This is interesting, as it again contrasts with the assumptions of the past research, which broadly suggests that individuals wish to conform to the norm, and remain within majorities (e.g. Cialdini & Trost, 1998; Sherif, 1936). In turn, it seems plausible that being criticised for doing something that "everybody else does" could be relatively more persuasive here, than being criticised while being in the minority. Given there were no differences in stress or anxiety between the groups, this effect may occur at a solely cognitive level, rather than an affective or physiological level. One related explanation for this follows research that suggests individuals can differ in terms of willingness to conform to norms. Some people have general preferences not to be in majorities (commonly referred to as non-conformism) (see: Goldsmith & Clark, 2005). The UK rates amongst the highest nations in terms of individualism (rather than collectivist) orientations. It's therefore possible that the participant pool (mostly people based at a UK university) could have been skewed towards non-conformism. This may have given an interaction between this dispositional factor and the majority group status, increasing willingness to change. However, this trait was not assessed directly in this study. Whether it occurred due to non-conformism, or as a general effect, this potential majority difference was overall quite interesting. It seems worth investigating further with a larger sample size, with greater power to pick up small or medium effect sizes.

5.6.1 Strengths and limitations

This lab study was carefully designed, piloted and had a sufficient sample size to detect large effects. The analysis was robust in that used both implicit and explicit measures, allowing for triangulation. The study design was informed by expert guidance, and other studies which have found social-psychological effects on HRV and EDA. Thus, the results seem convincing.

However, the study also had several limitations. Before concluding, it is worth considering that these limitations may have impacted on the results, and may have led to non-significance of the findings:

1. While the study had sufficient power to pick up on large effect sizes, it is possible that an effect of majority vs. minority status was significant, but with a small or medium effect size. In part, the sample size was defined by some practical limitations, including: the long duration of the study, time required to set up equipment, requirement for two experimenters to be present (etc.). A larger sample size, or repeated measures design could be employed to achieve sufficient power to detect such effects (Cohen, 1992), or an online study design could remove these practical barriers to participation.

2. It is plausible that the criticism employed in the study may have been too weak to encourage the sort of effects predicted. The data often showed that there was only an effect of 'time', and there was no significant effect of time on self-reported anxiety. In other words – the criticism overall seemed not to catalyse any meaningful differences in stress pre-to-post criticism. Anecdotally, several participants also noted that they did not find the criticism convincing, and believed it was designed to be part of the procedure. This could potentially be resolved with use of stronger, more convincing confrontation.

3. The abstractness of the card sorting task perhaps also contributed to the fact that in each condition participants were not very affected by the confrontation. Several participants commented after the study that they felt confused, given there was clearly no right or wrong way to sort the cards. The highly abstract nature of the study potentially undermined its purpose, given there was a lack of real world meaning. Similarly, the method of priming potentially was not sufficient to prime a meaningful in-group identification with the minority or majority group. In turn, it may be more suitable to use real-world examples which are more tangible and be even more explicit with priming of majority and minority status.

4. It could be argued that any potential influence of majority or minority identification was weakened by the fact that people participated in the lab study as *individuals*, and therefore were not in the presence of *other group members* (i.e. other people divided into majority or minority) during the confrontation. Some research has shown, for instance, that individuals tend not to bow to conformity pressures in tests, when given the chance to submit answers privately (Deutsch & Gerard, 1955). Further research could compare public versus private differences relating to this study's hypotheses. If this is not possible (e.g. for an online study), researchers should ensure any priming of norm condition is even more explicit.

Given these limitations, it may be worthwhile replicating the study, addressing each of the above points, to see if there are any majority-minority differences in responses to persuasive communication.

5.7 Conclusions

This chapter presented an experimental lab study that was designed to investigate the influence of majority-minority status on responses to criticism. Overall, the study does not support the idea that, at the most minimal of levels, majorities are 'self-protective'. This appeared to be the case, at least in terms of physiological and behavioural responses to criticism, when compared against a minority and a control group Analysis of HRV, EDA and self-reported state anxiety each showed no effects of norm status on peoples' responses to criticism, despite a well-planned, and well-controlled design. The results contrast with literature concerning the divisional effect, minimal group theory, minority stress, and risky shift.

However, while there were no significant differences between the conditions, the results were suggestive of an effect whereby the majority group was more willing to change behaviour following criticism. Furthermore, although the study was carefully planned and designed, it is possible that certain limitations of the study design meant significant effects were not uncovered.

Taking these points together, it seems worthwhile to investigate the same themes further in a follow up study. This follow up study should aim to achieve a larger sample size, feature clearer criticism, and utilize real world examples where behaviours are more concrete and tangible. To be even more thorough, a follow up study could potentially compare threatening versus non-threatening messages as well, to further assess whether majorities are more open or resistant to persuasion than minorities. These conclusions will form the basis of the next chapter.

5.7.1 Implications for climate change communication

The findings presented in this chapter suggest that the way people respond to confrontation is unlikely to be impacted by the majority or minority status of their current behaviour. However, given the limitations noted above, further work should be carried out on this topic before concrete practical implications can be drawn about this. The next chapter aims to address this.

Chapter 6

Majority and minority responses to threatening and non-threatening climate change campaign messages

6.1 Abstract

This chapter builds directly on the work in *Chapter 5*, to further test the idea that *under the assumption of majority or minority status, individuals may respond differently to critical messages about their current behaviour*. This chapter presents an online experiment in which participants respond to six campaign messages, with manipulated characteristics. The core elements and hypotheses of the previous study are replicated, this time with a larger sample size (N=190) and communication about real-life, climate-relevant behaviours. In addition to the possible influence of descriptive norm status (majority vs. minority vs. control), the present study also investigates how responses are impacted by communication styles (threatening vs. non-threatening), and behavioural request type (stop vs. reduce). The results of five mixed models showed that the (non)threatening style of message was the most influential factor on several attitudinal and behavioural outcomes. Perceived descriptive norm status and request type were also significant influences across four of five outcomes measured. Specifically, non-threatening message style, minority status, and requests to reduce (rather than stop) behaviour, consistently produced more favourable responses to communications. Additional regression analysis showed that self-efficacy, campaign attitudes, freedom threat, and prior issue importance also significantly influenced behavioural intentions across the campaigns. Results are discussed in relation to the previous chapters, as well as theory and practice related to climate change communication.

Highlights

- An online experiment is conducted (N=190), to understand the factors influencing responses to campaign messages about flooding, energy consumption and sustainable travel.

- The study involved manipulations of descriptive norm status (majority vs. minority. vs. control), communications style (threatening vs. non-threatening) and request type (stop vs. reduce).

- Administering a non-threatening communications style was the most influential factor for producing favourable campaign responses (in terms of campaign attitudes, behavioural intentions, freedom-threat, self-efficacy, and response efficacy).

- Minority status and ‘reduce’ (rather than ‘stop’) requests also led to more positive behavioural intentions, attitudes, self-efficacy and response efficacy.

- Self-efficacy, positive campaign attitudes, and prior issue importance were also positively associated with behavioural intentions in response to the campaigns, while freedom threat was negatively associated.

6.2 Introduction

The purpose of this chapter is to build on the findings of the 'majority-minority lab study' in *Chapter 5*, using a larger sample size, real life behaviours, and comparison between threatening and non-threatening communication styles. The main study presented in this chapter uses an online survey method, incorporating an experimental design to test responses to fictional campaign messages about real-life climate-relevant behaviours. It includes manipulations of descriptive norm status (i.e. majority vs. minority vs. control) communications style (i.e. high threat vs. low threat messages) and, as a by-product of the study design, request type (i.e. requests to stop vs. reduce behaviours).

The previous chapter set out to investigate whether, under minimal, highly controlled conditions, mere placement within a majority or minority group is sufficient to influence implicit (physiological) and explicit (self-reported) responses to criticism of behaviour. In the past chapter, it was hypothesized that *being in the majority would offer some form of protection from behavioural requests, limiting the persuasiveness of communication interventions and the stress caused by confrontation*. No significant differences between majority, minority and control conditions were found in terms of heart rate variability, electrodermal activity, or state anxiety. However, contrary to expectations, participants willingness to change behaviour was *suggestive* of an effect where the majority group appeared *more* likely to change their choice following criticism.

At the same time, several key limitations within *Chapter 5's* study design were identified, which may have prevented significant findings from emerging. These included:

(1) The sample size, which gave sufficient power to test for large effects, but not medium sized, or smaller, effect sizes;

(2) The delivery of criticism, which could have been stronger and more explicit; and

(3) The absence of real world meaning. While appropriate for testing responses to criticism in the absence of pre-existing beliefs, the study design may have meant that participants simply didn't care enough about the task to have been affected by the admonishment.

In this chapter, the interests in majority and minority differences are retained, and the above limitations are directly addressed. Given the findings in the previous chapter, this time it is predicted that *being in the majority will lead to more favourable responses to behaviour change requests, while being in the minority will cause resistance.*

Unlike the previous chapter, this chapter also introduces a comparison between 'high-threat' and 'low-threat' styles of communication. This is in part due to the limitation around delivery of criticism in previous lab study (as noted above) but also, to help address a pressing question raised in the literature review: *"to threaten or not to threaten?"* Past research presents contrasting evidence. There is evidence to suggest that seemingly threatening approaches can be persuasive – for instance, use of criticism, social pressure, or repeated threats to identity (Breakwell, 1986; Latané & Wolf, 1981; Sedikides & Jackson, 1990; Swim & Bloodhart, 2013; Witte & Allen, 2000). However, communications researchers also caution against approaches that are very threatening – such as fear appeals (without efficacy),

threats to values, freedom threats (Corner et al., 2014; Jaspal et al., 2013; Kahan, 2010; O'Neill & Nicholson-Cole, 2009). While these positions contrast, on balance non-threatening communications appear more favourable, given there is consistent work showing how freedom threatening communications can backfire. Furthermore, specifically in relation to climate adaptation, *Chapter 3* showed how people respond negatively to engagement that undermines psychological needs for efficacy. In turn, it is predicted that *low-threat communications will produce more favourable responses, including greater willingness to carry out recommended behaviours.* It is predicted also that *high-threat communications will negatively impact upon participants sense of efficacy.*

As part of the design of the main study, a further communications factor – request type – is also included to increase generalisability of results across behaviours (see methods). As a by-product this allowed analysis to also compare between requests to "stop" and "reduce" behaviours.

This chapter therefore sets out to address the following research questions:

RQ 1: Does the perceived majority or minority status of an individual's current behaviour influence their responses towards behaviour change requests in climate communication interventions?

RQ 2: Across a range of communications requests, do threatening communications styles produce more favourable responses than non-threatening styles?

RQ 3: Which factors - norm status, communications style or request type - are most influential in delivering favourable responses to communications? Are there interactions between these factors?

RQ 4: Following communications, which cognitive-level factors influence behavioural intentions?

The specific hypotheses are now presented, followed by methods, analysis and results for the pilot study and main study.

6.2.1 A note on how 'threatening communication' will be defined in this chapter

As noted above, and in the previous chapters, communications may be threatening in several ways. Communications may threaten values, identity, sense of freedom, create fear or involve personal criticism. Before this study can be conducted soundly, the type of threat(s) of interest needs to be rounded down, so that any manipulations can be controlled, and confounds are minimised.

Of resonance to *Chapter 3*, is the idea that freedom or sense of efficacy may be inhibited by communications that are in some way restrictive; preventing individuals from carrying out a course of action. Psychological Reactance Theory (PRT) provides a useful framework for understanding and operationalising such forms of threats. PRT suggests that threatening communications increase a sense of freedom threat, and lower behaviour willingness to comply with requests (Brehm, 1966, 2000; Dillard & Shen, 2005; Kronrod et al., 2012; Murtagh et al., 2012).

Threatening, or 'high-threat' communication here will therefore follow the definition of assertive communication offered in such research – being communication that uses an imperative form (e.g. "do," "go," and "you must") or leaves no option for refusal (Kronrod et al., 2012). A non-threatening, or 'low-threat' form of

communication will do the reverse, emphasising that individuals can freely make their own choices (i.e. “you are free to choose”, “it’s your own decision”) (Dillard & Shen, 2005, 2013). Following past studies in reactance, outcomes of interest will be behavioural intentions, sense of freedom threat experienced, and attitudes towards the piece of communication (Dillard & Shen, 2005, 2013). And, continuing work in previous chapters, implications for efficacy variables will also be considered. Details of measures will be given in the methods section.

6.2.2 Hypotheses

In response to the research questions above, the following hypotheses have been formulated:

- **H1(a):** Communications interventions targeting majority behaviours will be associated with more favourable campaign responses, relative to a control *(i.e. significantly more positive attitudes, higher behavioural intention, lower freedom threat, higher response/self-efficacy).*

  H1(b): Communications targeting minority behaviours will be associated with less favourable responses relative to the control (i.e. significantly less positive attitudes, lower behavioural intention, lower freedom threat, lower response/self-efficacy).

- **H2:** Low-threat campaigns will be associated with more favourable responses than high-threat campaigns *(i.e. significantly more positive attitudes, higher behavioural intention, lower freedom threat, higher response/self-efficacy).*

- **H3:** Communications style (i.e. level of threat) will be the most influential factor for behavioural and cognitive outcomes, compared with normative status, and request type.

- **H4(a):** Across all campaign responses, higher behavioural intentions will be associated with the following cognitive outcomes following communications interventions: lower sense of freedom threat, more positive campaign attitudes, higher issue importance, higher self-efficacy and higher response efficacy.

  H4(b): In terms of personality factors, lower trait reactance and more liberal political views will also be associated with higher behavioural intentions.

6.2.3 Ethical approval

Ethical approval for this research was granted by the University of Bath Ethics Committee within the department of Psychology, separately for the pre-screening study (Ref: 18-075) and main study (Ref: 18-029). To take part, participants were required to read over a detailed information sheet and provide voluntary consent, at the start of the survey. Participants had to be UK residents, over the age of 16, and fluent in the English language.

6.3 Study 1: Pre-screening survey to select behaviours

Before the main study could be carried out, an online pre-test survey (Study 1) was utilized to select the most appropriate target behaviours for the campaigns in the main study (Study 2). The aim for the main study was to include a broad range of climate related issues and behaviours, helping to increasing the generalizability and

ecological validity of the findings (Bryman, 2012). However, there was also a need to select behaviours that could reasonably be manipulated in terms of their majority-minority status. Study 1 therefore served to address these issues, guiding the selection of behaviours for the main study.

6.3.1 Method

A 'quick and dirty' online survey was conducted ahead of the main study to select the target behaviours. This survey was designed primarily to identify a range of behaviours where people were generally poor at assessing the behaviour's norm status (i.e. no clear consensus if it is a majority or minority behaviour). This information was crucial to allow convincing experimental manipulation of the majority/minority status of each behaviour in the main study.

Participants were asked to appraise a range of behaviours across five broad climate relevant issue categories: *flooding, travel, household energy consumption, food and dietary choices, and plastic usage*. These broad categories were chosen to reflect a range of issues, and were informed by previous literature on environmental behaviour and climate adaptation (e.g. Capstick et al., 2015; Clayton et al., 2015; Steg, Van Den Berg, & De Groot, 2013; Thomas, Poortinga, & Sautkina, 2016).

Then, to help identify specific behaviours within these categories, and ensure a broad spread of possible actions, inspiration was also taken from the Fogg Behaviour Grid (Fogg, 2009; Fogg, 2010).[1] As shown in *Figure 6.3.1*, this typology is useful in that it distinguishes between different directions of behaviour (e.g. stop, start, or reduce behaviour), and behaviour frequencies (one time, repeated, long term). It was thus useful to help identify and organise a good spread of behaviours, while controlling for potential confounds (i.e. it ensured behaviours had similar characteristics, aside from the issue type).

[1] Specifically, the newer version of the grid which has 15 cells was used, which is only displayed here www.behaviorgrid.org

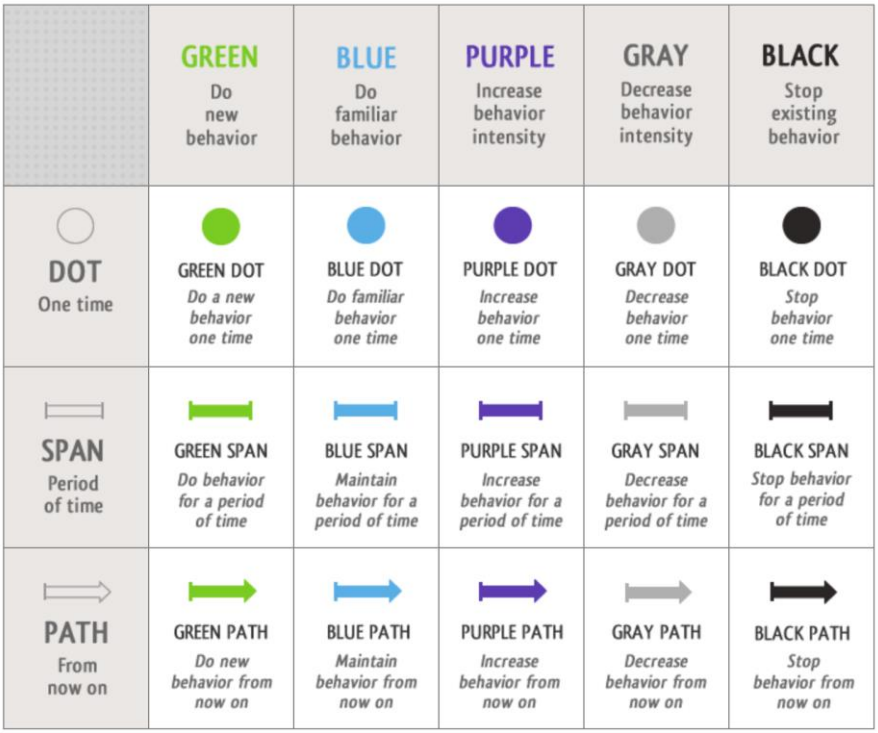


Figure 6.3:1 *- The Fogg Behaviour Grid (15 cell version) which was used to help formulate behaviours for the pre-screening survey.*

To give room for some behaviours to be 'dropped' through pre-screening, without losing entire issue categories, it was decided that multiple options for different behaviour types within the issue categories should be presented to participants (e.g. 2x 'stop' type behaviours within categories of flooding, energy, plastic and so on). Nevertheless, if applied across the 3x5 behaviour grid, this would have given an overwhelming number of options for participants to review.[2] Thus, some categories in the Fogg Behaviour Grid were ruled out.

First, some directionality (columns) were ruled out. Given the need to select behaviours where norm status was not well known, the *'do familiar behaviour*' (blue category) was ruled out. When considering real-world climate adaptation, communications aimed at *reducing* or stopping maladaptive behaviours, or *starting* a completely new adaptive behaviour seemed more realistic. Thus, '*increasing a pre-existing behaviour'* (purple category) was of lesser interest and was also ruled out. The present study therefore focused only on *'stopping existing behaviours'* (black category), '*starting a new behaviour'* (green category) and '*decreasing behaviour intensity'* (grey category). Secondly, the frequency (rows) were rounded down. The *'path'* (i.e. 'from now on') behavioural frequency was identified to be of primary interest – given communication interventions typically aim to create lasting adaptive responses. Therefore, the '*dot'* ('one time') and '*span'* ('period of time') rows were discounted.

Following this, two 'path' type behaviours, for levels of 'stop', 'start' and 'reduce' categories, were identified within each of the five issue categories. Altogether, this meant there were 30 behaviours participants had to appraise in the pre-screening

[2] i.e. (2 specific behaviours x 5 issue categories) x (3 behaviour frequencies x 5 behaviour directions)= 150 unique behaviours

survey. Flooding behaviours were identified in the interviews in *Chapter 3,* flood related campaigns,[3] and other related literature (e.g. Capstick et al., 2015; Dittrich et al., 2016). Other sources were used to identify specific behaviours in other issue categories, including:

- Past research on environmental behaviour (e.g. Capstick et al., 2015; Clayton et al., 2015; Steg, Van Den Berg, & De Groot, 2013; Thomas, Poortinga, & Sautkina, 2016)
- Guidance for individuals about personal environmental behaviour;[4] and carbon footprint websites, which recommend impactful personal climate change behaviours,[5]
- Policy interventions (e.g. Defra, 2016)
- Experiential knowledge about possible environmental actions.

These behaviours are presented in *Table 6.3.1* below.

Table 6.3:1 *- Behaviours included in the pre-screening survey.*

Issue Category	**Behaviour Type**		
	Start	**Reduce**	**Stop**
Flooding	Volunteering for a community flood action group in your local area	Reducing my personal carbon footprint (change diet to low meat, low dairy, reduce household energy consumption, use sustainable transport etc.)	Not flushing any non-flushable items down the toilet (baby wipes, hygiene wipes, cleaning wipes, cleansing pads and sanitary products)
	Regularly donating to a flood prevention charity	Reducing the amount of fat going down the drain from your cooking (by disposing of fat oil, and grease into the kitchen bin)	Stopping supporting MPs that are weak on flooding issues and flood prevention.
Energy	Buying low energy/energy efficient light bulbs for every room in your property/accommodation	Reducing the amount of time you spend in the shower	Not using the high temperature settings (e.g. 60ºC) on the washing machine
	Unplugging / turning off equipment you might normally leave on standby	Reducing the number of laundry cycles I do	Not using a tumble drier altogether

[3] E.g. www.wessexwater.co.uk/help-and-advice/your-wastewater/blockages
[4] E.g. friendsoftheearth.uk/climate-change/what-can-I-do-to-stop-climate-change and davidsuzuki.org/what-you-can-do/top-10-ways-can-stop-climate-change/
[5] E.g. www.footprintcalculator.org and footprint.wwf.org.uk

Travel	Carbon offsetting your flights (every time you fly)	Reducing the number of taxi / Uber journeys I take	Stopping travelling in cars for any short distance journeys (under 3 miles)
	Cycling or walking for all short distance journeys (under 3 miles distance)	Reducing the number of flights you take each year	Not taking short distance flights, where public transport can be feasibly used instead (e.g. internal / UK-Europe flights)
Plastic	Regularly carrying a reusable bottle for water	Reducing the number of new plastic bags you use/buy for carrying shopping	Stopping buying plastic bottled water altogether
	Recycling more than 90% of your personal plastic waste	Reducing the number of food items you purchase that are packaged/sealed in a plastic wrap (such as fruit, vegetables, baked goods)	Saying no to plastic straws and disposable cutlery
Food/Diet	Buying most of your food from local sources (i.e. locally produced, locally grown)	Reducing meat and dairy consumption	Stopping meat and dairy consumption altogether
	Buying mostly organic food and drink produce	Reducing consumption of processed foods	Not buying food products that are sourced from outside Europe (e.g. fruit and veg, fish, meat, poultry)

The measure of interest in this survey concerned perceived majority/minority status. Participants were asked about each behaviour separately, with the same format (e.g. *"Fill in the gap: _____ do NOT volunteer for a community flood action group*"). Participants were asked to choose a response from 4 x options: "Most people (a majority) / About half of people (close to 50%) / A small number of people (a minority) / I don't know / I'm not sure how many people". This question was designed to have clear construct validity – for instance, mentioning explicitly the words *majority* and *minority*.

Given physical constraints, effort and other barriers can potentially interfere with peoples' perceptions about self-efficacy to carry out behaviours (Fogg, 2009; Service, et al., 2014) participants were also asked about the perceived difficulty of behaviour, measured on a 7-point Likert scale (1= very easy, 7= very difficult). This

information was also taken into account when selecting behaviours for the main study, to ensure unnecessarily difficult actions were not selected.

The study was created in Qualtrics and was piloted with postgraduate colleagues (N=13), to ensure the instructions were clear and the survey duration was not unreasonably long (averaging c.19mins). Following feedback, some minor amendments were made to wording and presentation (e.g. adding colour to emphasize the directionality of behaviour). The survey was then promoted to the public, using convenience sampling with recruitment via University noticeboards and on social media. This gave a reasonable sample size for the pre-screening (N=103). An example of a pre-screening question about descriptive norms is given below (see *Figure 6.3.2*).

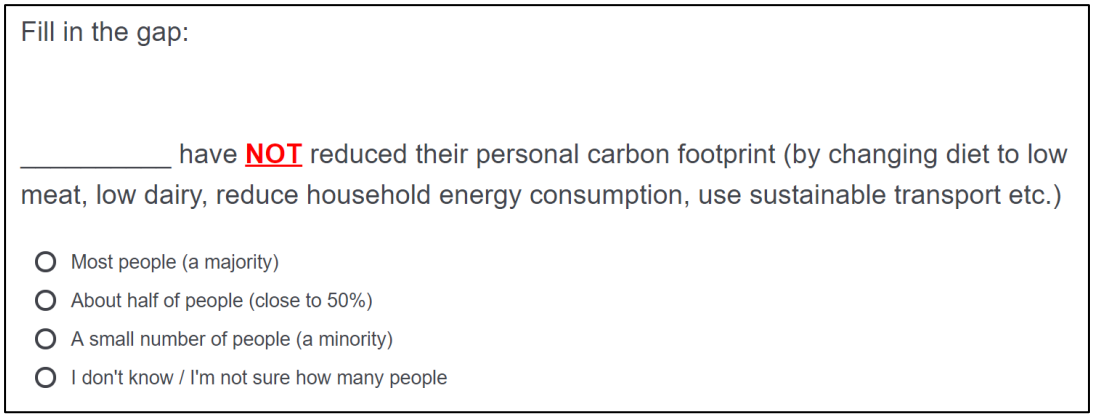


Figure 6.3:2 *- An example pre-screening survey question, to help identify disagreement about descriptive norms for a range of actions.*

6.3.2 Analysis

As noted, the primary aim of the pre-screening was to identify behaviours where there was a lack of knowledge about the *commonness* of specific behaviours (i.e. whether the behaviours had majority or minority status). Given the need to ensure there were multiple behaviours within common issue categories in the main study (e.g. floods, plastic or energy), while analysis focused on specific behaviours (as identified above), this was conducted to help select/rule out entire issue categories. There were different ways analysis could logically assess this, using the measures about perceived majority/minority status:

1. Assessing the relative levels of disagreement – related to behaviours and issues. This could involve assessing the spread of responses given (e.g. by calculating standard deviations).
2. Assessing the extent of uncertainty (e.g. calculating the number of 'don't know' responses).
3. An approach which combines both options above (e.g. creating an index or aggregate score, that can then be used to create a ranked list of behaviours in terms of disagreement and uncertainty).

Each of these approaches made logical sense, and therefore were all carried out in the analysis and findings were triangulated across the outputs.

As noted above, ideally the selection of behaviours would also consider potential perceived barriers. Given this, repeated measures ANOVAs were carried out to assess if there were perceived differences in perceived ease/difficulty of stop start

and reduce behaviours. This was also considered in the final selection of behaviours. The results, including issue/behaviour selection process are now presented.

6.3.3 Results

The results of the survey showed that behaviours related to flooding, household energy usage and travel had more 'don't know/not sure' responses, than behaviours in other categories (See *Table 6.3.2*). This highlighted that in general, participants felt more uncertainty about the commonness of behaviours related to flooding, energy and travel, compared to behaviours related to plastic and food.

***Table 6.3:2** - Issue categories ranked by the total number of 'don't know/not sure' responses about descriptive norms*

Issue	Total 'don't know'
Floods	118
Energy	103
Travel	93
Plastic	62
Food	47

In addition, there was relatively greater disagreement about the commonness of travel, energy and floods behaviours, relative to the plastic and food behaviours. This was assessed by calculating standard deviation (SD) scores for peoples' norm appraisals of behaviours. The average standard deviation scores for behaviours within each issue category is presented in *Table 6.3.3*. A greater standard deviation indicates greater disagreement around the descriptive norms of behaviours.

***Table 6.3:3** - Issue categories ranked by standard deviation (SD). Higher SD indicates a larger spread across the responses – indicating greater disagreement about the descriptive norms.*

Issue category	Average SD
Travel	1.056
Energy	1.022
Floods	0.998
Plastic	0.947
Food	0.833

Finally, a process of ranking behaviours was carried out, to help assess norm appraisals of specific behaviours with the issue categories. To do this, an aggregate score for each specific behaviour was calculated, which combined both standard deviation scores with number of 'don't know' responses. To create a common metric, the SD and 'don't know' data were converted to normalised units (NU - i.e. scores on a common scale between 0-1). The formula used to calculate normalised units was as follows:[6]

[6] Following the method presented here: https://www.statisticshowto.com/normalized/

$$x_{new} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

Normalised unit scores for the SD data, and 'don't know' data, were then averaged to create an aggregate normalized unit score for each behaviour. These scores were then used to rank all 30 behaviours (see *Table 6.3.4*).

Once behaviours were ranked, a selection process was carried out. The selection method involved identifying the highest-ranking stop, start and reduce behaviours in each issue category (again, see *Table 6.3.4*). To be included in the main study, the three issue categories with the highest ranking 'full set' of stop, start and reduce behaviours were identified. These three issue categories were travel, flooding and energy, and the last two categories were plastic and food. Triangulating across these pre-screening outputs, it was therefore decided that plastic and food categories would not be used in the main study.

Table 6.3:4 *- The 30 pre-screened behaviours ranked by an aggregate normalized unit, which takes into account disagreement in responses, and count of 'don't know' responses. The highest-ranking stop, start and reduce behaviours within each issue category have been highlighted in bold, and colours have been added to distinguish between the issue categories.*

Behaviour	SD	N.U (SD)	Count 'don't know'	N.U (Don't knows)	Aggregate N. U
StopFloodsWeakMPs	1.31	1.00	54.00	1.00	**1.00**
ReduceTravelUberTaxis	1.26	0.94	29.00	0.53	**0.73**
StartTravelCarbonOffset	1.18	0.84	19.00	0.34	**0.59**
ReducingEnergyLundryCycles	1.16	0.82	18.00	0.32	**0.57**
ReducingEnergyShower	1.12	0.78	18.00	0.32	**0.55**
ReduceTravelFlights	1.14	0.79	16.00	0.28	**0.54**
ReduceFloodsOilDrain	1.10	0.75	16.00	0.28	**0.52**
StopFoodOutsideEU	1.10	0.75	15.00	0.26	**0.51**
StopTravelShortFlights	1.09	0.73	16.00	0.28	**0.51**
StopPlasticStrawsCutlery	1.09	0.73	16.00	0.28	**0.51**
StopEnergy60DegreeWash	0.96	0.58	22.00	0.40	**0.49**
StopEnergyTumbleDrier	0.99	0.62	18.00	0.32	**0.47**
ReducePlasticFoodWrapped	1.03	0.67	12.00	0.21	**0.44**
ReduceFloodsCarbonFootprint	1.03	0.66	12.00	0.21	**0.44**
StartFloodsVolunteer	1.02	0.65	12.00	0.21	**0.43**

StopPlasticAllBottledWater	1.01	0.64	12.00	0.21	**0.42**
ReduceFoodProcessed	0.99	0.61	13.00	0.23	**0.42**
StartEnergyEcoLightbulbs	0.93	0.55	16.00	0.28	**0.42**
StartEnergyUnplugStandby	0.96	0.58	11.00	0.19	**0.39**
ReduceFoodMeatDairy	0.96	0.57	10.00	0.17	**0.37**
StartFloodsDonate	0.93	0.54	9.00	0.15	**0.35**
StartPlasticRecycle90	0.94	0.55	8.00	0.13	**0.34**
StopFloodsFlush	0.79	0.37	15.00	0.26	**0.32**
StopTravelShortCarJourneys	0.87	0.47	7.00	0.11	**0.29**
StartPlasticCarryBottle	0.86	0.46	6.00	0.09	**0.27**
StartTravelCycleWalk3miles	0.81	0.40	6.00	0.09	**0.25**
ReducePlasticShoppingBags	0.76	0.33	8.00	0.13	**0.23**
StartFoodLocal	0.73	0.30	5.00	0.08	**0.19**
StartFoodOrganic	0.73	0.30	4.00	0.06	**0.18**
StopFoodMeatDairy	0.48	0.00	1.00	0.00	**0.00**

Finally, a further analysis was carried out to assess possible differences in perceived difficulty of stop, start and reduce type behaviours. Though not a main study hypothesis, it was predicted that stopping a behaviour altogether would be considered more difficult than starting or reducing a behaviour. Ahead of this analysis, average scores of perceived difficulty (across all issue categories) were calculated for stop, start and reduce type behaviours. The average scores for perceived difficulty were normally distributed, as assessed by observing normal Q-Q plots for each behavioural level (stop, start, reduce). There were no outliers detected, or unusual data points.

A repeated measures ANOVA was performed to assess whether there was a difference in *perceived difficulty* between stop, start and reduce behaviours. The perceived difficulty was higher for start type behaviours (*M*= 3.08, SD= 0.70) compared with stop behaviours (M= 2.88, SD= 0.80), then reduce behaviours (*M*= 2.86, SD= 0.79). Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated, $\chi^2(2)= .405$, $p= .817$. Perceived difficulty was significantly different between the levels of stop, start and reduce $F(2, 204)= 8.862$, $p <.001$, partial $\eta 2= 0.08$.

A Bonferroni post-hoc test was conducted to investigate differences between stop, start and reduce levels.[7] This post-hoc test showed that between start and reduce behaviours, there was a statistically significant mean difference in difficulty scores of 0.23, SE= 0.61, *p*= .001; and there was also a significant difference between the start and stop perceived difficulty scores of 0.21, SE= 0.60, *p*= .003. Together, this

[7] A Bonferroni correction was applied given this is generally considered suitable for making multiple post-hoc comparisons in repeated measures ANOVA (Maxwell et al., 2004).

analysis illustrates that *start* behaviours were viewed as being significantly more difficult, compared to stop and reduce behaviours.

Although not a main analysis in this chapter, and effect sizes were small, these ANOVA outputs are interesting to note (given the reasonable sample size achieved, power achieved via repeated measures, and broad range of behaviours and issues considered). In turn, it was decided that, to avoid unnecessarily confounding results in the main study due to perceived barriers, 'start' type behaviours would also be excluded from the main experiment. The ranking (*Table 6.3.4*) was therefore reviewed once more, and the highest-ranking start behaviours were excluded. The final selection of behaviours for the main study is presented in *Table 6.3.5* below.

Table 6.3:5 *- Final selection of behaviours for the main study, within the issue categories: flooding, energy and travel*

	Request type	
Issue category	**Reduce**	**Stop**
Flooding	Reducing the amount of fat going down the drain from cooking (by disposing of fat oil, and grease into the kitchen bin)	Stopping supporting MPs that are weak on flooding issues and flood prevention.
Energy	Reducing the amount of time spent in the shower	Not using the high temperature settings (e.g. 60ºC) on the washing machine
Travel	Reducing the number of taxi / Uber journeys taken	Not taking short distance flights, where public transport can feasibly be used instead (e.g. internal / UK-Europe flights)

6.4 Study 2: Campaign responses online experiment

Once specific issue themes and behaviours were selected, it was possible to carry out the main study. This study is now presented in the following sections. The study responds to the research questions and hypotheses laid out earlier in this chapter. The focus is therefore on the potential influence of majority-minority status, (non)threatening message style and request type on people's campaign responses. Different responses are considered - attitudes towards the campaign, sense of freedom threat, behavioural intentions, self-efficacy and response-efficacy. Also, the study aims to address the relative influence of cognitive factors on behavioural intentions across the study (i.e. which cognitive factors best explain adaptive responses?). The methods are detailed in the following sections.

6.4.1 Methods

6.4.2 Recruitment

Participants were recruited via convenience sampling. Study adverts were placed on the UoB Psychology department's study recruitment panel, social media and survey recruitment websites.[8] Adverts directed participants to the online study.

6.4.3 Participants

Data were collected from 190 people. Of the participants, 149 were female (78.4%), 37 were male (19.5%), 3 were gender variant/non-conforming (1.6%) and 1 preferred not to answer. Ages ranged from 16 to 62 (M= 30.03, SD= 11.10). Participants' political views (measured on a scale where 1=very liberal, 4= moderate or middle of the road, 7=very conservative) were skewed towards the more liberal end of the spectrum (M= 2.88, SD= 1.27). In terms of political voting intentions, the largest segment of participants were Labour voters (34.2%), followed by Liberal Democrats (17.4%), and Green Party supporters (12.6%).

Table 6.4:1 *- Participants' political voting intentions: "How would you vote if there were a general election tomorrow?"*

Political Party	Frequency	Percent
Conservative	9	4.7
Labour	65	34.2
Liberal Democrat (LibDem)	33	17.4
UK Independence Party (UKIP)	4	2.1
Green	24	12.6
Scottish Nationalist (SNP)	3	1.6
Would not vote	7	3.7
Don't know / unsure / undecided	31	16.3
Not eligible to vote	14	7.4
Total	190	100.0

6.4.4 Design

The study was hosted on the survey platform Qualtrics, which features randomization and survey flow features, allowing experimental designs to be administered online. The main experimental component of the study was structured as a multilevel repeated measures design with the following factors:

Campaigns (six variants comprising two overlapping 3x2 repeated measures designs):

- Issue type (3 levels: floods, energy, travel)
- Request type (2 levels: stop, reduce)

And:

- Norm status (3 levels: majority, minority, control)
- Message style (2 levels: threatening, non-threatening)

[8] An incentive was used to help recruitment. This was a random prize draw for a £50 voucher.

The design was set up so that every participant experienced a set of six separate campaigns, the content of which was manipulated, with randomisation, to cover the possible combinations of each 3x2 design. Across the six campaigns, all participants viewed content about the three issue types, and for each issue type, participants experienced stop and reduce requests (the content of which was presented earlier in *Table 6.3.5*, following the pre-screening study). The structure of this element is illustrated in *Figure 6.4.1* below:

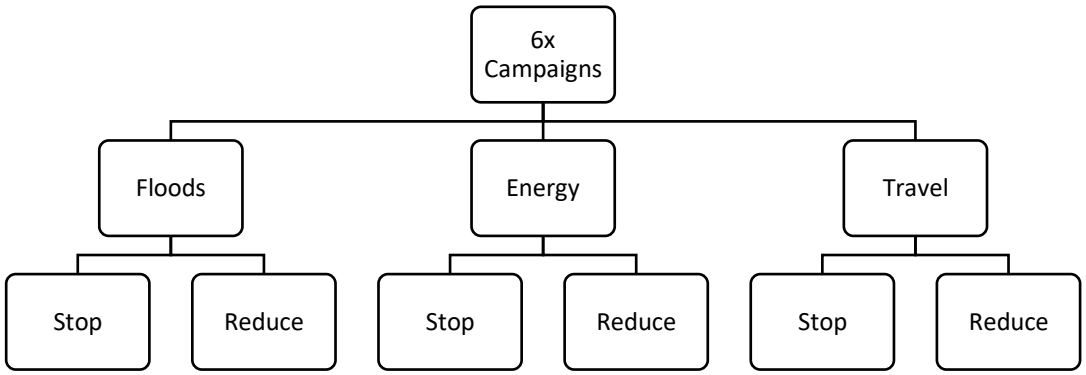


***Figure 6.4:1** – The issue type and request type hierarchy*

In addition, whilst participants experienced the six campaign levels above, every participant also experienced the three norm conditions (majority, minority, control), and for each of the norm conditions, participants experienced both a threatening and non-threatening message style. The structure of this is illustrated in *Figure 6.4.2* below:

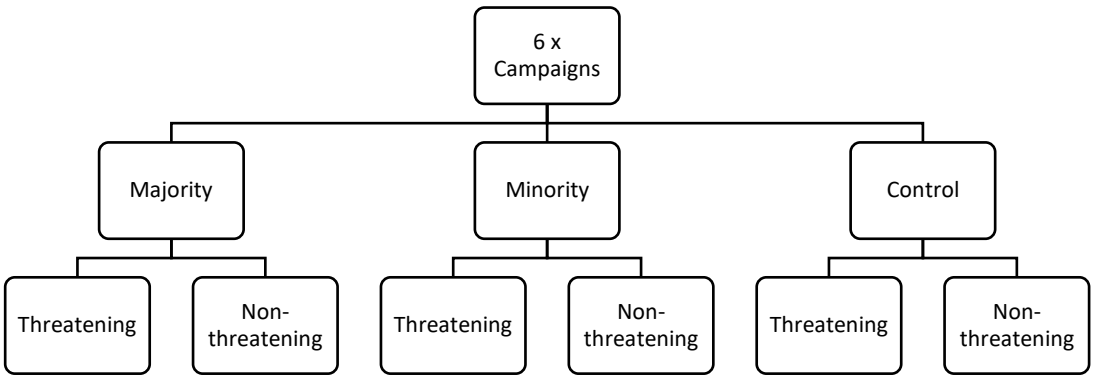


***Figure 6.4:2** - The message style and norm status hierarchy*

Put together, this (3x2) x (3x2) design meant there were 36 unique campaign iterations possible. To clarify, each participant did not view all 36 campaigns – they viewed six only. But whichever six of the 36 possible campaigns participants did view, they will each have viewed each of the six possible combinations of 'issue type x request type', as well as each of the six possible combinations of 'norm condition x message style'. An example participant experience when viewing six possible campaigns is given in *Table 6.4.2*. Note how all six possible combinations for 'issue x request' and 'norm condition x message style' are experienced within six campaigns.

Table 6.4:2 *- The 36 possible campaign variations with an example participant experience of six random campaigns (see bold rows).*

Campaign Variant	Issue	Request	Norm Condition	Message Style
1	Flood	Stop	Majority	Threatening
2	Flood	Stop	Majority	Non-threatening
3	Flood	Stop	Minority	Threatening
4	Flood	Stop	Minority	Non-threatening
5	**Flood**	**Stop**	**Control**	**Threatening**
6	Flood	Stop	Control	Non-threatening
7	**Flood**	**Reduce**	**Majority**	**Threatening**
8	Flood	Reduce	Majority	Non-threatening
9	Flood	Reduce	Minority	Threatening
10	Flood	Reduce	Minority	Non-threatening
11	Flood	Reduce	Control	Threatening
12	Flood	Reduce	Control	Non-threatening
13	Energy	Stop	Majority	Threatening
14	Energy	Stop	Majority	Non-threatening
15	Energy	Stop	Minority	Threatening
16	Energy	Stop	Minority	Non-threatening
17	Energy	Stop	Control	Threatening
18	**Energy**	**Stop**	**Control**	**Non-threatening**
19	Energy	Reduce	Majority	Threatening
20	**Energy**	**Reduce**	**Majority**	**Non-threatening**
21	Energy	Reduce	Minority	Threatening
22	Energy	Reduce	Minority	Non-threatening
23	Energy	Reduce	Control	Threatening
24	Energy	Reduce	Control	Non-threatening
25	Travel	Stop	Majority	Threatening
26	Travel	Stop	Majority	Non-threatening
27	**Travel**	**Stop**	**Minority**	**Threatening**
28	Travel	Stop	Minority	Non-threatening
29	Travel	Stop	Control	Threatening
30	Travel	Stop	Control	Non-threatening
31	Travel	Reduce	Majority	Threatening
32	Travel	Reduce	Majority	Non-threatening
33	Travel	Reduce	Minority	Threatening
34	**Travel**	**Reduce**	**Minority**	**Non-threatening**
35	Travel	Reduce	Control	Threatening
36	Travel	Reduce	Control	Non-threatening

6.4.5 Procedure

After reading over an information sheet, and supplying consent to take part in the study, participants began the survey. As a cover story, the introduction explained to participants that the experimenters did not design the campaigns, and that campaigns will be tailored to them personally, based on the information they provide. Following this, participants responded to pre-test measures, and then viewed the six campaigns. The survey had the following structure:

1. Information sheet and consent form
2. Introduction
3. Pre-test measures (prior issue importance)
4. Campaigns (3 issues x 2 requests) shown in random order, each presented as follows:
    a) Campaign briefing, and check of participant's current behaviour related to the specific campaign (e.g. stop x flood)
    b) Participants shown information about normative status relating to their current behaviour (i.e. majority vs. minority vs control)
    c) Campaign message shown (e.g. flood x stop), framed with a specific message style (threatening vs. non-threatening).
    d) Measures of cognitive outcomes relating to campaigns (behavioural willingness, campaign attitudes, freedom threat, self-efficacy, response-efficacy)
5. Debriefing

Further details relating to the materials and measures of the study are now provided.

6.4.6 Materials and stimuli

6.4.7 Descriptive norm manipulation

To test whether perceived descriptive norm status influences peoples' responses to persuasive communications, participants were led to believe that their behaviour was of majority or minority status *before* any communications intervention was administered. In the study introduction, participants were informed that, following feedback during a pilot study, participants would be given information about how their current behaviour compares with others (see *Table 6.4.3*). This was the cover story used to allow descriptive norm feedback to be given in relation to each campaign behaviour.

***Table 6.4:3** - Information about behaviour feedback, used as a cover story for the descriptive norm manipulations*

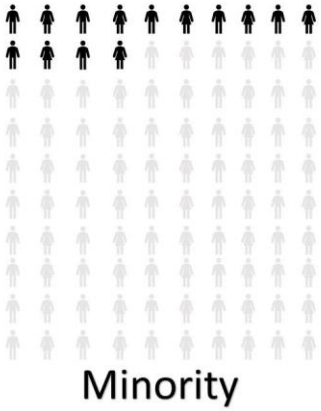
"Before seeing each campaign, you will be provided with a campaign briefing to give you some background information. You will also be asked about your current actions in relation to each campaign. When we piloted this survey, respondents wanted to know how common their behaviours were. We updated the survey to provide some statistics about how you compare to others (where possible). These statistics are taken from the results of a recent National Social Science Survey. The statistics are not available for all specific behaviours mentioned the survey. So, don't worry if a message appears saying "no statistics are available" - just carry on with the survey as normal.

Then, just before each campaign, two pages in the survey were dedicated to the execution of the descriptive norm manipulation. For each campaign behaviour (e.g. 'floods x stop', or 'energy x reduce') participants were presented with a very short campaign briefing – informing them of the topic of the campaign. Participants were then required to respond to a question about their behaviour in relation to the issue at hand. For instance:

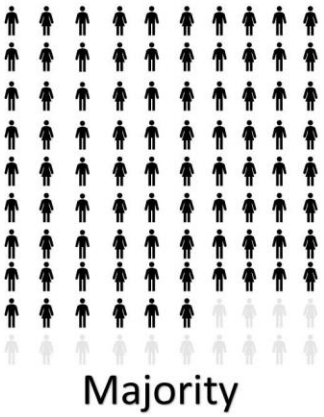
"Your Current Behaviour: *Have you already completely stopped all support for politicians who are weak on flooding issues and flood prevention? (Feedback will be provided on the next page) [Response options: Yes/No]*

The wording of such pre-campaign questions was framed in such a way as to force participants into selecting the 'No' response option. This meant participants were required to self-identify as an individual who is *not yet carrying out the behaviour that would be recommended in the campaign*. [9] This was done to ensure the norm feedback would be in relation to their current *undesirable behaviour*, rather than in relation to any pro-environmental behaviour they may be practicing (recall that we wanted participants to think that their current behaviour had majority or minority status, ahead of a campaign requests targeting that behaviour). This also helped minimize potential bias of pre-existing behaviour, as all participants were interacted with from an equal baseline of having 'not yet carried out the campaign behaviour'. On the next page, participants were then presented with the norm feedback, in relation to their behaviour. This page informed participants that their behaviour was either in the minority or majority, with graphics to represent this (see *Figure 6.4.4*). For the control condition, a message read "Sorry, no statistics were available in the national survey database for this specific behaviour. Please continue with the survey".

[9] If participants did happen to select 'Yes', a message informed that they would still be shown the campaigns, meaning that norm feedback was still carried out on the next page. An example message for the 'floods x stop' behaviour was: *"Given you have already completely stopped supporting politicians who are weak on flooding, the following campaign may seem a little irrelevant to you. Nevertheless, we will still give you feedback on your behaviour and show you the campaign, as we're still interested in what you think."*



FEEDBACK: YOUR BEHAVIOUR IS IN THE MINORITY!
According to the result of the national survey, you are in the **minority**. Your behaviour is **very unusual.**



FEEDBACK: YOUR BEHAVIOUR IS IN THE MAJORITY!
According to the result of the national survey, you are in the **majority**. Your behaviour is **very normal**.

Figure 6.4:3 *- Minority (top) and majority (bottom) feedback relating to participants' behaviours, prior to the 'personalized campaign message'.*

Once participants had seen this norm feedback information, they were required to confirm they had read and understood the information ("Please click 'Yes' to confirm your position within the [majority/minority] and view the campaign"). 100% of respondents selected 'yes' when asked. This indicated that every participant had acknowledged their norm status, prior to each campaign.

6.4.8 Threatening vs. non-threatening message style

As noted earlier, the operationalization of threatening vs. non-threatening message style was informed by existing examples in the literature on reactance which emphasize contrasts between freedom threatening messages (Dillard & Shen, 2005; Kronrod et al., 2012). Threatening messages were thus created using the imperative form (i.e. 'should', 'must' etc.), while non-threatening language did the opposite (i.e. emphasizing that individuals have freedom to choose). To ensure any message effects were not confounded by other factors, the structure of the text was kept consistent across the campaigns (*Table 6.4.4*). The structure was based on the FEMA framework (Fact, Evaluation, Motivation, Action) as has been used in other studies with communications messages (e.g. Mogles et al., 2017). This was adapted slightly (to: Evaluation, Request, Motivation, Action), for the specific needs of this study. A short title was also created to reflect the message style for each campaign, and images typifying the issue and behaviour were presented above the text. To minimise any unnecessary biases (e.g. positive or negative valence) all images used were chosen to reflect the denotative content of the issue and did not show any people.

Table 6.4:4 *- An example of threatening vs. non-threatening text presented for the 'travel x reduce' campaign*

Threatening	Non-threatening
DON'T TAKE A TAXI! "It's disgusting that you're still taking taxis and Ubers for short journeys! You must reduce this to an absolute minimum right now! It is absolutely essential to combat climate change and air pollution effectively. You have no choice but to do the right thing - DON'T TAKE A TAXI!"	**Uber Free from Taxis** "It's up to you if you still take short taxi and Uber rides. Nevertheless, it would be great if you can reduce this to a minimum. Cutting down taxis and Uber rides is important for combatting climate change and air pollution. But of course, you have a free choice whether you go Uber Free from Taxis"

6.4.9 Measures

Campaign responses were measured by assessing perceived campaign attitudes, perceived freedom threat, behavioural intention, self and response efficacy.

Campaign attitudes were measured on a 7-item semantic differential scale, sourced from Dillard & Shen (2005). Responses were scored on 7-point scales with items of:

bad/good, foolish/wise, unfavourable/favourable, negative/positive, undesirable/desirable, unnecessary/necessary, detrimental/beneficial. As in past work, a mean value was taken to give an overall campaign attitude score.

Freedom threat was measured on a 4-item scale ("the message threatens my freedom to choose", "the message tried to make a decision for me", "the message tried to manipulate me", "the message tried to pressure me"), as sourced from Dillard & Shen (2005). Responses were scored from 1 (strongly disagree) to 5 (strongly agree). Again, a mean value was taken as an overall score of threat to freedom.

Behavioural intention was measured according to Dillard & Shen (2005) by asking for participants' responses to one item ("How likely is it that you will now change your behaviour in the way recommended by the campaign?"), with scoring ranging from '0%' to '100%' (this was operationalised as a 10-point scale).

Self-efficacy was measured with one item, adapted from Hart & Feldman (2016) ("Personally, I feel able to carry out the action suggested") rated from 1 (strongly disagree) to 5 (strongly agree).

Response-efficacy was also measured with one item, adapted from Hart & Feldman (2016): "I feel like the recommended course of action will be effective in reducing the problem", rated from 1 (strongly disagree) to 5 (strongly agree).

For additional analysis, trait reactance, prior issue importance, and political orientation was measured. As in other chapters, *trait reactance* was measured using the Hong reactance scale (Hong & Faedda, 1996). *Prior issue importance* was measured at the start of the study, before participants viewed any of the campaigns. Following Murtagh et al. (2012) this was operationalised using a one item measure, which was adapted for each of the issue themes (e.g. Being someone who ['takes action about flooding and flood risk'] is an important part of who I am). *Political orientation* was measured in two ways. First as political worldview (as in Hart & Feldman, 2016), measured on a 7-point scale (1= Very conservative, 4= moderate or middle of the road, 7= Very liberal). Second, for descriptive statistics, it was measured as political voting intention (UK political party options given as choices). Finally, basic demographic measures of age and gender were also taken.

6.4.10 Missing data

As in other chapters, all participants selected for analysis had fully completed the study, and participants were prompted for responses to unanswered questions, meaning that missing data was minimized. In fact, there was 0% missing data for all outcome measures in the study (e.g. issue importance, campaign attitudes, behavioural intentions, freedom threat, self-efficacy and response-efficacy). Thus, no action was taken to correct missing data.

6.4.11 Analysis

6.4.12 Linear mixed models with fixed, random and repeated factors.

The main effects of the various campaign characteristics were assessed through analysis of modern linear mixed models. This was carried out in SPSS. Linear mixed models (LMM) are well suited to analysis where there are several categorical predictors, potentially with unequal levels, and also when there are repeated observations (Crawley, 2012; Johnson & Onwuegbuzie, 2004). Mixed models can assess how influential predictor variables are for specified outcomes, while taking into account the potential influence of 'random factors' that may also exert some

influence on the outcome, despite not being of primary interest (Johnson & Onwuegbuzie, 2004; LaMotte, 2004). Mixed models are suitable for continuous and ordinal outcome measures, and can give information about where differences between levels occur in predictor variables (IBM, 2020; Johnson & Onwuegbuzie, 2004; McCulloch & Neuhaus, 2005).

The aim of the present mixed models analysis was to understand how the various campaign characteristics, or dimensions, influenced participants appraisals of those campaigns. As noted above, appraisals were measured with five dependent variables: behavioural willingness and campaign attitudes (both continuous measures), as well as freedom threat, self-efficacy and response efficacy (all ordinal). Linear mixed models were run for continuous outcomes, while generalized linear mixed models (GLMM) were run for ordinal outcomes.

Ahead of the analyses, data on the randomisation order and content viewed by each participant (i.e. the specific combinations of campaign factors within the six campaigns experienced) was exported from Qualtrics and matched to participants' responses in SPSS. Data was transposed from 'case' format, to 'wide/long' format in SPSS ahead of the analysis – as is required for mixed models. This meant that each participant had six rows of data – each representing a response to one of the 6 campaigns viewed. In total, for 190 participants, this gave 1140 unique trials (i.e. campaign responses).

Ahead of the analysis, trials were screened out when participants indicated they were *already* doing the behaviour that would be recommended in the campaign (i.e. when participants reported they were already doing the desirable action). This is because:

(a) The initial idea for the study was about targeting maladaptive practices (not adaptive responses)

(b) Given the descriptive norm manipulation was issued in relation to *existing* behaviour, it would have incorrectly suggested that a [majority/minority] were also doing a *desirable* practice, rather than the *undesirable* one being targeted.

(c) The campaign would have requested something the participant is already doing, thus seeming less relevant.

To fit the models, an initial model was specified, based around the hypotheses. For this, fixed, random and repeated factors first had to be specified. There is considerable disagreement about what constitutes a 'fixed' versus a 'random' effect in the literature. Gelman (2005) highlights five key ways the constructs have been distinguished in the literature, each with merit:

1. Fixed effects are constant across individuals, while random effects vary (Kreft & de Leeuw, 1998).
2. Fixed effects are of interest in themselves, and random if there underlying population is of interest (Searle et al., 1992).
3. When a sample is the complete population (i.e. there are no other possibilities) it is a fixed effect. When the sample is a small or incomplete part of the population, it is random (Green & Tukey, 1960).
4. If an effect is assumed to be a realized value of a random variable, it is a random effect (LaMotte, 2004).
5. Fixed effects are estimated using least squares or maximum likelihood; random effects are estimated with shrinkage (Robinson, 1991).

Given this, there is a degree to which any researcher must select and justify an approach. For the analysis, *message style*, *descriptive norm condition*, *request type* and *gender* were specified as fixed factors. These variables were of 'interest in themselves' (see point 2 above), and provide a 'complete population', where there were no other possible levels within the factors (see point 3). For instance, for *message style* effects, the 'threatening' versus 'non-threatening' styles encompassed the full range of levels that were of interest – rather than a small, random sample of a much larger number of possibilities. The same was true for descriptive *norm condition* (majority vs. minority vs. control).

While arguments could be made against *request type* (stop vs. reduce) being included as a fixed effect (given the pilot study considered three types of request - stop vs. reduce vs. start), following the pilot study, this variable became *of interest* in itself. Thus, stop versus reduce represented the full range of possibilities of this interest in the main study. Of course, applying a simple binary definition of *gender* (i.e. male vs. female) is limited in its ability to describe a complete population. Given this, the survey itself gave participants a range of options to describe their gender identity. However, given only four participants either did not disclose their identity or selected a non-binary option, for simplicity of analysis these participants were excluded, and gender is treated as a fixed effect with two levels in the model (making N=186 when included in the model).

Issue type was treated as a random effect – given it was not of primary interest, and the three issue types (floods, travel and energy) are clearly a small sample of many possible environmental behaviours that could have been studied. Nevertheless, by including these as random effects, they are still accounted for in the model, strengthening the analysis.

In summary, for each analysis – message style, descriptive norm condition, request type and gender were specified as *fixed* factors, while *issue type* was specified as a random factor. *Campaigns* were specified as the *repeated measure*, with six levels (i.e. six time points). In generalized models, repeated measures cannot be specified, and therefore campaigns were entered as a random effect within these procedures.

Finally, while direct fixed effects were of greatest interest for hypothesis testing, there might also be potentially revealing interactions between some of these fixed factors. Two-way and three-way interactions between message style, norm condition and request type were therefore also specified in the initial model. To summarise, the initial model dimensions are presented in *Table 6.4.5*.

Table 6.4:5 *- Initial model dimensions specified*

		Number of Levels
Fixed Effects	Intercept	1
	Message Style	2
	Norm Condition	3
	Request	2
	Gender	2
	Message Style * Norm Condition	6
	Message Style * Request	4
	Condition * Request	6
	MessageStyle * Norm Cond. * Request	12
Random Effects	Intercept + Issue	4
Repeated Effects	Campaign*	6
Total		48

*LMM's only. In GLMMs Campaign was specified as a random effect.

6.4.13 Covariance structure

To select the best fitting covariance structure, a comparison was run with 'campaign attitudes' as the outcome variable, to check model fit between options.[10] Initially, the covariance structure was specified as unstructured for random and repeated effects – which assumes different variance at each time point / pairing. The Akaike's Information Criterion (AIC= 1803.418), a value for model fit, was improved by specifying both the random and repeated effects with 'identity' structures, which assumes constant variance at each time point, and independence of observations (AIC= 1784.727). The identity structure also improved the final LMM on freedom threat (AIC before= 1953.624, AIC after= 1868.76). For the GLMMs, unstructured covariance was not possible, due to computational power required, so consistent with the final LMMs, an identity structure was specified for random factors throughout. This structure is also recommended in software developer guidelines for GLMM (IBM, 2020).

6.5 Results

6.5.1 Mixed models[11]

Two linear mixed models and three generalized linear mixed models were fit to analyse the impact of the campaign characteristics on individual cognitions. To iteratively fit a final model, a stepped process was adopted, where non-significant fixed effects with the highest p-value were removed until only significant fixed effects remained, giving a final model (Crawley, 2012). The fixed factors which were removed are presented in *Table 6.5.1* below.

[10] Specifically, this was the final model after non-significant factors were removed (see results sections).

[11] Given there is no standard for reporting modern linear models, the reporting style has been informed by a clear example from a reputable journal (Wenger et al., 2016), and tailored slightly to the needs of this study.

Table 6.5:1 *- p-values of non-significant fixed factors at point of removal from models*

Fixed Factor	Campaign attitudes	Freedom threat	Behavioural-Intentions	Self-efficacy	Response-efficacy
Message Style	-	-	-	-	-
Norm Condition	-	.734	-	-	-
Request	-	.980	-	-	-
Gender	.518	.335	.479	-	.841
MessageStyle * Norm Condition	.943	.967	.960	.959	.426
MessageStyle * Request	.097	.146	.679	.424	.513
Norm Condition * Request	.910	.095	.707	.906	.952
MessageStyle * Norm Condition * Request	.823	.880	.952	.939	.949

Note: All figures reported are p-values at the point of removal from the models.

The significant fixed effects of the five mixed models, and values of model fit are presented in *Table 6.5.2* below. Across the mixed models, message style (threatening/non-threatening) had a significant fixed effect on each of the five outcome variables: Campaign attitudes, freedom threat, behavioural intentions, self-efficacy and response-efficacy. The manipulation of normative condition (majority/minority/control) had a significant effect on four of the outcomes: Campaign attitudes, behavioural intentions, self-efficacy and response-efficacy, but was non-significant in relation to freedom threat. Similarly, the manipulation of request type (stop/reduce) had a significant effect on four of the outcomes: Campaign attitudes, behavioural intentions, self-efficacy and response-efficacy, but was non-significant in relation to freedom threat. The following sections will now detail the results of each of the five models.

Table 6.5:2 *- Final model results (fixed effects)*

		Linear Mixed Models [a]		Generalized Linear Mixed Models [b]		
	Df1	Campaign Attitudes	Freedom Threat	Behavioural Intentions	Self-Efficacy	Response Efficacy
Message Style [c]	1	**169.819*** **	**1019.372*** **	**67.696*** **	**28.075** **	**31.022*** **
Norm Condition [c]	2	**3.202***	-	**3.460***	**4.727** **	**4.812** **
Request [c]	1	**17.850*** **	-	**6.137***	**40.705*** **	**26.688*** **
Gender [c]	1	-	-	-	**4.260***	-
Intercept [c]	1	**4708.585*** **	**3710.393*** **	-	-	-
Corrected Model [c]	-	-	-	**19.842*** **	**15.722*** **	**16.327*** **
Levels	-	18	13	190	186	190
No. Subjects	-	190	190	190	186	190
Df2 (denominator)	-	308.706	279.035	652	645	662
Log Likelihood	-	1780.727	1864.766	14518.941	7897.914	9586.844
Akaike Inf. Crit.	-	1784.727	1868.766	14522.960	7901.933	9590.862
Bayesian Inf. Crit.	-	1793.727	1877.774	14531.901	7910.853	9599.834
Model accuracy [d]	-	-	-	25.6%	41.3%	63.4%

*p < .05., **p < .01., *** p < .001
a Measurement Level: Continuous; Repeated Covariance Type: Identity. Random Covariance Type: Identity;
b Measurement Level: Ordinal; Probability Distribution: Multinomial; Link Function: Cumulative Logit; Random Covariance Type: Identity
c Reported effect sizes are F values
d Model accuracy is defined as overall percent of cell counts in ordinal outcome variable correctly predicted (information only available for GLMM)
Note: Differences in levels and Df2 (denominator) between the LMM and GLMM outputs is due to the repeated factor with 6x levels (campaigns) being treated as a random factor in the GLMMs. Df2 is also influenced by the covariance structure applied. Number of observations/subjects in the self-efficacy model is 186 as gender was included as a fixed effect.

6.5.2 Campaign attitudes

A linear mixed model was fit to analyse the influence of the campaign manipulations on participants' (negative to positive) attitudes towards the campaign. The final model showed significant fixed effects of message style, norm condition, and request type (F=4708.585; *p* <.001; *Table 6.5.2*). The AIC of the final model was 1784.727.

The results indicated that non-threatening messages induced significantly more positive attitudes in response to the campaigns, compared to threatening messages (*p* <.001; *Table 6.5.3*). Requests to stop produced significantly less positive attitudes, compared with reduce requests (*p* <.001; *Table 6.5.3*). There was a significant difference between the control and minority condition, with the minority norm feedback resulting in more positive campaign appraisals (*p*= .013; *Table 6.5.3*). The difference between the majority and control was non-significant (*p*= .095; *Table 6.5.3*). A post hoc-test check was carried out to assess if there was also a difference between majority and minority levels, however, there was no significant difference here (*p*= .377, *Table 6.5.4*).

Table 6.5:3 *- The results of the linear mixed model for campaign attitudes*

Parameter	Level	Estimate	Std. Error	df	t	*p.*
Message Style	Non-threatening	.814310	.062488	516.538	13.031	**.000**
	Threatening	0	0	.	.	.
Norm Condition	Majority	.126986	.075852	523.940	1.674	.095
	Minority	.194712	.078382	540.662	2.484	**.013**
	Control	0	0	.	.	.
Request Type	Stop	-.254130	.060150	381.188	-4.225	**.000**
	Reduce	0	0	.	.	.

Where zero or missing values are reported, this is the reference category.

Table 6.5:4 *- Result of post-hoc test*

Level	Comparison Level	Mean Difference	Std. Error	df	*p.*
Majority	Minority	-.068	.077	518.333	.377
	Control	.127	.076	523.940	.095

Test applied LSD adjustement for multiple comparisons.

6.5.3 Freedom threat

A linear mixed model was fit to analyse the influence of the campaign manipulations on participants' sense of freedom threat following the campaigns. The final model showed that message style had a significant fixed effect (F=3710.393; *p* <.001; *Table*

6.5.2). The AIC of the final model was 1868.766. The results indicated that non-threatening messages induced significantly lower freedom threat in response to the campaigns, compared to threatening messages (*p* <.001; *Table 6.5.5*). There were no other significant fixed effects in the model.

Table 6.5:5 *- The results of the linear mixed model for freedom threat*

Parameter	Level	Estimate	Std. Error	df	t	*p*.
Message Style	Non-threatening	-2.227411	.069764	566.170	-31.928	**.000**
	Threatening	0	0	.	.	.

Where zero or missing values are reported, this is the reference category.

6.5.4 Behavioural intentions

A generalized linear mixed model was fit to analyse the influence of the campaign manipulations on participants' intentions to carry out the behaviours recommended in the campaigns. The model showed that message style, norm condition, and request type had significant fixed effects (F=19.842; *p* <.001; *Table 6.5.2*). The overall model accuracy was 25.6%, (AIC= 14522.960).

The results indicated that non-threatening messages induced significantly higher behavioural intentions in response to the campaigns, compared to threatening messages (*p* <.001; *Table 6.5.6*). Requests to stop produced significantly lower behavioural intentions, compared with reduce requests (*p*= .013; *Table 6.5.6*). There was a significant difference between the control and minority condition, with the minority norm feedback resulting in higher behavioural intentions (*p*= .010; *Table 6.5.6*). The difference between the majority and control was non-significant (*p*= .414; *Table 6.5.6*). To assess if there were differences between majority and minority levels, analysis was repeated with reference categories changed. This showed that there was no significant difference between the majority and minority levels (*p*= .073, *Table 6.5.7*).

Table 6.5:6 *- The results of the generalized linear mixed model for behavioural intentions*

Parameter	Level	Coefficient	Std. Error	t	*p*.
Message Style	Non-threatening	1.171	.1424	8.228	**.000**
	Threatening	0	.	.	.
Norm Condition	Majority	.136	.1666	.818	.414
	Minority	.437	.1698	2.571	**.010**
	Control	0	.	.	.
Request Type	Stop	-.351	.1415	-2.477	**.013**
	Reduce	0	.	.	.

b. This parameter is set to zero because it is redundant.

Table 6.5:7 *- Result of post-hoc test*

Parameter	Level	Coefficient	Std. Error	t	*p*.
Norm Condition	Control	-.136	.1666	-.818	.414
	Minority	.300	.1673	1.795	.073
	Majority	0	.	.	.

Where zero or missing values are reported, this is the reference category.

6.5.5 Self-efficacy

A generalized linear mixed model was fit to analyse the influence of the campaign manipulations on participants' sense of self-efficacy following the campaigns. The model showed significant fixed effects of message style, request type, norm condition and gender (F=15.722; *p* <.001; *Table 6.5.2*). The overall model accuracy was 41.3% (AIC= 7901.933).

The results indicated that non-threatening messages induced significantly higher self-efficacy in response to the campaigns, compared to threatening messages (*p* <.001; *Table 6.5.8*). Requests to stop produced significantly lower self-efficacy, compared with reduce requests (*p* <.001; *Table 6.5.8*). Males had higher self-efficacy, compared to females, in response to the campaign (*p*= .039; *Table 6.5.8*). There was a significant difference between the control and minority condition, with the minority norm feedback resulting in higher self-efficacy (*p*= .003; *Table 6.5.8*). The difference between the majority and control was non-significant (*p*= .485; *Table 6.5.8*). To assess if there were differences between majority and minority levels, analysis was repeated with reference categories changed. This showed that there was a significant difference between the majority and minority levels, where the minority level produced higher self-efficacy in response to the campaigns (*p*= .022, *Table 6.5.9*).

Table 6.5:8 *- The results of the generalized linear mixed model for self-efficacy*

Parameter	Level	Coefficient	Std. Error	t	*p*.
Message Style	Non-threatening	.764	.1442	5.299	**.000**
	Threatening	0	.	.	.
Norm Condition	Majority	.119	.1711	.698	.485
	Minority	.520	.1766	2.944	**.003**
	Control	0	.	.	.
Request Type	Stop	-.964	.1512	-6.380	**.000**
	Reduce	0	.	.	.
Gender	Male	.360	.1743	2.064	**.039**
	Female	0	.	.	.

Where zero or missing values are reported, this is the reference category.

Table 6.5:9 *- Result of post-hoc test*

Parameter	Level	Coefficient	Std. Error	t	*p*.
Norm Condition	Control	-.119	.1711	-.698	.485
	Minority	.400	.1742	2.299	**.022**
	Majority	0	.	.	.

Where zero or missing values are reported, this is the reference category.

6.5.6 Response-efficacy

A generalized linear mixed model was fit to analyse the influence of the campaign manipulations on participants' sense of response efficacy, following the campaigns. The model showed there were significant fixed effects for message style, and request type and norm condition (F=16.327; *p* <.001; *Table 6.5.2*). The overall model accuracy was 63.4% (AIC= 9590.862). The modelling showed that non-threatening messages induced significantly higher response efficacy in relation to the campaigns, compared to threatening messages (*p* <.001; *Table 6.5.10*). Requests to stop produced significantly lower response efficacy, compared with reduce requests (*p* <.001; *Table 6.5.10*). There was a significant difference between the control and minority condition, with the minority norm feedback resulting in higher response-efficacy (*p*= .024; *Table 6.5.10*). The difference between the majority and control was non-significant (*p*= .468; *Table 6.5.10*). To assess if there were differences between majority and minority levels, analysis was repeated with reference categories changed. This showed that there was a significant difference between the majority and minority levels, where the minority level produced higher response-efficacy after the campaigns (*p*= .003, *Table 6.5.11*).

Table 6.5:10 *- The results of the generalized linear mixed model of response efficacy*

Parameter	Level	Coefficient	Std. Error	t	*p*.
Message Style	Non-threatening	.998	.1792	5.570	**.000**
	Threatening	0	.	.	.
Norm Condition	Majority	-.155	.2128	-.727	.468
	Minority	.497	.2204	2.256	**.024**
	Control	0	.	.	.
Request Type	Stop	-.947	.1834	-5.166	**.000**
	Reduce	0	.	.	.

Where zero or missing values are reported, this is the reference category.

Table 6.5:11 *- Result of post-hoc test*

Parameter	Level	Coefficient	Std. Error	t	*p*.
Norm Condition	Control	.155	.2128	.727	.468
	Minority	.652	.2173	2.999	**.003**
	Majority	0	.	.	.

Where zero or missing values are reported, this is the reference category.

6.5.7 Multiple regression predicting behavioural willingness

To further understand the relative influence of cognitive outcomes (following the campaigns) on participants' behavioural willingness, a multiple linear regression was carried out. The outcome variable was participants' self-reported behavioural willingness, and the predictor variables were: campaign attitudes, freedom threat, self-efficacy, response-efficacy, prior issue importance, trait reactance and political views. Political views were considered here given the substantial body of research showing the influence of (political) values and worldviews on environmental behaviour, and to build on analysis of values in *Chapter 4*. Gender was added as a control variable.

The dependent variable was normally distributed as assess through inspection of a histogram and a normal P-P plot of standardized residuals. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.948. There was a linear relationship between the dependent variable and the collective independent variables, and homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. Each independent, continuous variable was linearly related to the dependent variable, as assessed through partial regression plots. There were no issues of collinearity observed, with all correlations between independent variables <0.7 and with a maximum VIF value of 1.84 at any point during the analysis (Hair et al., 2014). One possible outlier was detected by inspection of studentized deleted residuals for values ±3 standard deviations. This was not found to be an unexpected value (given survey options), nor exhibit high leverage (with a leverage value well below <0.2). However, the case did have high influence, as indicated by a Cooks Distance value of <1 (Cook & Weisberg, 1982). This case was therefore removed from the analysis, out of caution. Two other cases were found to exhibit high leverage, both with leverage values above 1.00, which is much greater than the .05 threshold considered to be 'risky' by Huber (1981). These two cases were therefore also removed.

Following the removal of these three cases, one further possible outlier was detected by inspection of studentized deleted residuals for values ±3 standard deviations. However, it was not an unexpected value (given survey options); all cases at this stage were found to have leverage values <0.2, which is considered safe (Huber, 1981) and, there were no problematic cases in terms of influence, according Cooks Distance values, which were all <1 (Cook & Weisberg, 1982). Therefore, no further cases were removed from the analysis.

As in other chapters, the method of fitting the model selected was to step backwards, removing non-significant variables until only significant variables remained in the

model. At each step the variable with the highest p-value was removed. Variables were removed in the following order (with p-values stated at the point of removal): gender (*p*= .969), trait reactance (*p*= .724), political views (*p*= .477) and then response-efficacy (*p*= .155).

R^2 for the final overall model was 0.40 with an adjusted R^2 of 0.38, a large effect size according to Cohen (1988). Campaign attitude, freedom threat, self-efficacy and prior issue importance significantly predicted behavioural intentions F(4, 178)= 29.19, *p* <.001. Regression coefficients and standard errors can be found in *Table 6.5.12* (below).

Table 6.5:12 *- Summary of linear regression analysis for variables predicting mean behavioural intentions in relation to six campaigns (N=182).*

Variable	*B*	*SE B*	*β*
(Constant)	.087	1.039	
Campaign Attitudes	.720	.176	**.269*** **
Freedom Threat	-.670	.165	**-.247*** **
Self-Efficacy	.568	.210	**.177*** **
Prior Issue Importance	.488	.110	**.269*** **
R^2		**.38**	
F		**29.19*** **	

*$p < .05$., **$p < .01$., *** $p < .001$

6.6 Discussion

This study has shown that (non-)threatening message style, perceived descriptive norm status, and request type are consistently influential for a range of individual level cognitions in response to climate-relevant campaigns. These communication factors each were influential for behavioural intentions, campaign attitudes, self-efficacy and response efficacy, following the communications. The most influential factor, judged by effect size across the campaigns, was the message style, and this was also the only factor found to have a significant effect on perceived freedom threat. This fit with the study predictions (H3). Specifically, as hypothesized (H2), the study found that a non-threatening message style consistently led to more favourable campaign responses (i.e. more positive attitudes, lower freedom threat, higher

behaviour intentions, higher self-efficacy and higher response efficacy) compared to a threatening style.

The majority status was not significant from the control level, contrary to predictions (H1a). In fact, the reverse was found (H1b), as when participants were primed to believe their behaviour was of minority status ahead of the campaign interventions, this led to more favourable responses (i.e. more positive attitudes, higher behaviour intentions, higher self-efficacy and higher response efficacy) compared to the control, when no descriptive norm feedback was given. For self-efficacy and response efficacy, the minority status also led to significantly higher scores, compared to the majority.

Generally, across the campaigns, higher behavioural intentions were also associated with a lower sense of freedom threat, more positive campaign attitudes, higher prior issue importance, and higher self-efficacy following the campaigns. This mostly supported the relevant hypothesis (H4a), as of the five dynamic cognitive factors predicted to be significant, only response-efficacy was not significant. Contrary to predictions (H4b), personality factors of trait reactance and political views were not found to be significant influences on behavioural intentions, following the campaigns.

The outcomes of the hypothesis testing are summarized in *Table 6.6.1* below.

Table 6.6:1 *- Summary of hypothesis testing*

Hypothesis	**Outcome**
H1(a): Communications interventions targeting majority behaviours will be associated with more favourable campaign responses, relative to a control *(i.e. significantly more positive attitudes, higher behavioural intention, lower freedom threat, higher response/self-efficacy).*	**Not supported** – the majority did not differ from the control.
H1(b): Communications targeting minority behaviours will be associated with less favourable responses relative to the control (i.e. significantly less positive attitudes, lower behavioural intention, lower freedom threat, lower response/self-efficacy).	**Not supported** – the reverse was found, with the minority condition resulting in more favourable responses to the campaigns for 4/5 of the outcome variables, compared to the control *(i.e. significantly more positive attitudes, higher behavioural intention, higher response/self-efficacy).*
H2: Low-threat campaigns will be associated with more favourable responses than high-threat campaigns *(i.e. significantly more positive attitudes, higher behavioural intention, lower freedom threat, higher response/self-efficacy).*	**Supported** - A non-threatening message style gave more favourable campaign responses in relation to all outcome variables *(i.e. significantly more positive attitudes, higher behavioural intention, lower freedom threat, higher response/self-efficacy),* compared to a threatening style.
H3: Communications style (i.e. level of threat) will be the most influential factor for behavioural and cognitive outcomes, compared with normative status, and request type.	**Supported** – The message style was consistently the most influential factor across the outcome variables and was highly significant in every mixed model.

H4(a): Across all campaign responses, higher behavioural intentions will be associated with the following cognitive outcomes following communications interventions: lower sense of freedom threat, more positive campaign attitudes, higher issue importance, higher self-efficacy and higher response efficacy.	**Mostly supported** – As predicted, higher behavioural intentions were associated with lower freedom threat, positive campaign attitudes, prior issue importance, and higher self-efficacy. However, contrary to predictions, response efficacy was non-significant.
H4(b): In terms of personality factors, lower trait reactance and more liberal political views will also be associated with higher behavioural intentions.	**Not supported** – trait reactance and political views were also non-significant.

These findings contribute new knowledge to the literature in several ways. Firstly, the finding that *priming a minority status ahead of an intervention then leads to more favourable communications responses when the intervention is administered*, is novel to our knowledge. This finding has clear resonance with work on social norm influences on pro-environmental behaviour (e.g. Cialdini & Trost, 1998; Goldstein et al., 2007; Keizer & Schultz, 2013; Nolan et al., 2008; Reno et al., 1993). Such work has repeatedly shown that messages which highlighting majority practices tends to further influence uptake of such actions amongst a minority who are not yet carrying out the action. The present research suggests that a similar effect is possible, but rather than highlighting what the majority are doing within the persuasive communication, this can be achieved by priming minority status ahead of a piece of persuasive communication, amongst those not yet carrying out the recommended action. This finding is also in accordance with some aspects of Social Impact Theory (SIT, Latané, 1981, 1996; Sedikides & Jackson, 1990). Previous SIT research has suggested that smaller groups and individuals alone, rather than larger groups, are more easily persuaded. Though subtly different (as the SIT work was not operationalized as majority-minority differences), the present research suggests that when individuals are led to believe that their behaviour is similar only to a minority of others (i.e. a small group), they are more susceptible to persuasion than when no feedback is given. What would be interesting to test further is whether there can also be a 'spill over minority effect' – if individuals are primed to believe they are in a minority related to one action, are they also more likely to change another action, shortly after priming?

The finding that the majority did not differ from the control at any point in the study, is also of importance. This suggests *that being in the majority does not offer protection from persuasion* – and contrasts with the suggestive outcome of the lab study in *Chapter 5*. The previous chapter suggested that the majority groups are more likely to change their behaviour following confrontation. This was also confirmed further by their being no-interaction effect in the present study, which may have suggested the majority respond more favourably than the minority or control, when communication style is *threatening*. Overall, these findings contrast with the idea in SIT that a 'divisional effect' occurs when individuals believe they are in a large group, buffering individuals against persuasion (Latané, 1981, 1996; Sedikides & Jackson, 1990). Instead, the present study suggests that the most important factor is *whether individuals believe they are in the minority*. Relating this back to dredging support in flood affected communities, as in *Chapters 3 and 4*, it now seems unlikely that the majority status alone explains why dredging support persists. This is in some

ways reassuring for communicators, as it suggests when a practice is perceived to have majority status, this alone does not act as a buffer to confrontation, or act as barrier to behaviour change intervention. This is at least the case when comparing 'majority status' to having 'no knowledge of how widespread a practice is' (as suggested by comparisons with the control group).

The study also builds on evidence that non-threatening communications tend to result in more favourable responses to behavioural requests, and that communications which threaten freedom to choose are relatively less persuasive (Brehm, 1966; Brehm, 2000; Dillard & Shen, 2005, 2013; Kronrod et al., 2012; Murtagh et al., 2012). The present study extends this research, in three key ways. First, while previous research has shown that freedom threatening communications can increase a sense of freedom threat, diminish behavioural intentions and produce more negative attitudes; the present study is the first to show specifically that freedom threats can also inhibit a sense of state self-efficacy and response-efficacy. This is an important finding given the clear role that efficacy appears to play in promoting a range of adaptive responses to climate change and other forms of threats. This suggests that a non-threatening style of communication should be adopted to prevent efficacy from being diminished. This is a crucial finding in relation to previous chapters too, as it provides clear evidence that efficacy can be inhibited by communications style alone. This supports the finding in *Chapter 3* that the efficacy of flood affected participants may have been inhibited by authorities' engagement techniques. And this extends other research which has highlighted that a lack of agency in flood affected communities can lead to negative wellbeing (Walker-Springett et al., 2017), suggesting that engagement style may play a role in this. This supports the suggestion by Climate Outreach, that flood affected communities should be engaged with sensitively, or communications may backfire, and that efforts should be made to nurture efficacy and empowerment to promote adaptation (Corner et al., 2020; Messling et al., 2015).

Secondly, the present research shows that the effects of (non)-threatening message style occurs across a range of climate relevant issues. This suggests that highly assertive approaches to communication, a framing often used in environmental campaigns (see: Kronrod et al., 2012), are likely to be less effective than less assertive approaches. This is at least apparent for encouraging other members of the public to respond favourably to one-time requests. However, further research would be needed to establish whether threatening or non-threatening approaches are more efficacious longitudinally, or with specific audiences (e.g. decision makers in positions of power). Thirdly, the study also extends previous research on communications, by suggesting that effects (non)threatening communication style are relatively much more substantial than priming descriptive norm status.

In addition, the present study also adds original knowledge by highlighting that request types consistently play an important role in people's responses to climate communications. While the Fogg Behaviour Grid identifies directional categories such as start, reduce, and stop (Fogg, 2009a, 2010), to our knowledge, no research had tested for general differences between stop, start or reduce requests, especially not in relation to climate actions. The finding in the present research clearly suggests that *requests to stop* consistently result in less *favourable responses*, compared to *requests to reduce*, which result in *more favourable responses*. Though not tested in the main study, the pre-screening study also suggested that *requests to start a new behaviour* are viewed as being *more difficult* than stop and reduce actions. Given

that environmental communications often deal in assertive absolutes (i.e. "you must stop doing X behavior")[12] the findings have clear implications for the way practitioners should make behavioural requests.

Finally, the study has shown via regression analysis that several cognitive factors explained adaptive responses across the campaigns. This showed once more that self-efficacy is an important precursor to adaptive responses to climate change, fitting with similar research findings (Doherty & Webler, 2016; Murtagh et al., 2012; van Valkengoed & Steg, 2019). This further suggests that Protection Motivation Theory is a useful framework, given the central role of self-efficacy in this theory. However, the finding that freedom threat and campaign attitudes were also similarly influential predictors suggests that PMT is not fully explanatory. PMT can thus be complimented by incorporating elements of Psychological Reactance Theory to explain responses to communication level factors. Furthermore, the result that response-efficacy was a non-significant predictor also suggests refinement of PMT is useful. This specific finding reinforces results in *Chapter 4* – that different forms of efficacy are associated with different levels of responses (i.e. self-efficacy for personal-level responses, response-efficacy for policy-level responses, and collective efficacy for social-level responses). The flood, travel and energy actions requested in this study were mostly personal level responses – and therefore it makes sense that self-efficacy was explanatory while response efficacy was not. This adds further weight to the idea that PMT can be modified to include different response levels.

The significance of prior issue importance for adaptive behaviour in this study also chimes with Kronrod et al., (2012), who found that participants who believed issues were important in advance of communication interventions tended to respond more favourably. However, unlike Kronrod and colleagues' study, the present research did not test for interactions between issue importance and message style. The finding non-significance of political views in this study perhaps suggests that political values are less influential for adaptation than mitigation (fitting with: Kahan, 2013; Zhang et al., 2020). However, given the analysis looked generally at behavioural intentions across the study, it thus aggregated together actions that are more typical of climate adaptation (e.g. reducing flooding) with mitigation actions (e.g. sustainable travel). Thus, any role of political views may have been obfuscated.

The finding that trait reactance was also non-significant is interesting. The study overall suggests that *state reactance* is more important for influencing responses. This is in contrast with past research that suggests trait reactance is an important antecedent to people's responses to communications (Dillard & Shen, 2013; Hong & Faedda, 1996). This finding suggests that communicators may not need to take into account these sorts of individual differences – as even those who have lower trait reactance will respond more negatively to threatening communications. However, it is possible this trait reactance was non-significant because the regression analysis looked for general responses across both threatening and non-threatening campaigns. It is possible that trait reactance only is activated in relation to threatening campaigns.

[12] For instance, Kronrod et al (2012) highlight Greenpeace's "Stop the catastrophe" and Plant for the Planet's "Stop talking. Start planting." to represent the typical styles employed in environmental campaigning. Each of these campaigns include absolute stop requests.

6.7 Conclusion

Building on the previous chapter, this online experiment addressed people's responses to a range of communications manipulations, presented as campaigns related to flooding, travel and household resource consumption. The study has shown that the threatening vs. non-threatening style of communication has a consistent, and substantial effect on people's responses to climate related communications. It also demonstrated that perceived minority status and request types and influence responses to communication. Furthermore, a positive direct influence of self-efficacy on personal level climate actions was again demonstrated here, alongside freedom threat, campaign attitudes and prior issue importance. Together, the work clearly shows that stylistic framings of communications can be tailored to alter people's engagement with adaptive responses to climate change.

6.7.1 Strengths and limitations

This study built on the limitations of the lab study in the previous chapter, by increasing the power available to uncover effects, through recruiting a larger sample size and using a repeated measures design, which allowed many campaigns to be trialled. Unlike the previous chapter, it also employed a clearer form of threatening communication, and made comparisons against non-threatening communication; and in addition, applied the communications to a range of real-world climate issues. Given these improvements, the study had clear strengths overall, with good construct validity, ecological validity and generalizability (Bryman, 2012).

Despite this, the study had some limitations. One limitation was that by attempting to make the message style clear (in comparison to the lab study) the threatening communication style may have inadvertently included language that introduced a confound. Specifically, the messages stated that "It is disgusting if you are still doing X". The use of the word *disgust* here may have laced the messages with additional connotations, alongside the imperative form that is common in freedom threatening messages (i.e. "should", "must"). Disgust sensitivity is a field of research in its own right, and there is evidence to suggest that disgust can influence a range of behavioural responses, with certain value groups predisposed to be more sensitive to disgust (e.g. Inbar et al., 2012). It is therefore possible that this term added noise to the findings. While this does not undermine the differences found between the threatening vs. non-threatening communications styles, it makes it more difficult to disentangle precisely which aspects of the (non-)threatening style led to this effect.

On a similar note, it may also be considered a limitation that the research only set out to test one form of threat (i.e. freedom threat). As noted earlier, there are several ways in which communications can be threatening – for instance, toward identity, or by inducing a sense of fear. It would be interesting to assess differences between different types of threats in further research.

The sample recruited for the study was majority female, and this may also be viewed as a limitation to the generalizability of the findings. Nevertheless, the mixed models accounted for possible effects of gender, and clearly showed that there was only a gender effect for self-efficacy. Another sample limitation was that political views were skewed toward more liberal orientations, and this should be considered when drawing inferences from the study.

6.7.2 Implications for climate change communication

This work has obvious implications for climate change communicators. The study suggests that:

- The communication style adopted when making environmental requests should be *non-threatening*, as this induced a greater willingness to take the action, more favourable attitudes, a lower sense of freedom threat, and greater self and response efficacy.

- Priming a belief that existing behaviour has *'minority status'* (i.e. only carried out by the minority) makes individuals more likely to respond favourably and change their behaviour. Where possible (and not deceptive), communicators should highlight the minority status of maladaptive actions, prior to requesting that individuals change such behaviour. Doing so is likely to improve behavioural intentions, attitudes towards the communication, self-efficacy and response efficacy.

- Requests to *reduce*, rather than *stop*, current behaviours, appear to result in more favourable responses. Asking individuals to reduce behaviours is likely to promote greater willingness to take the action, more positive attitudes, self-efficacy and response efficacy, compared with requests to stop.

While this chapter has generalizable implications across a range of climate-related issues and actions, all chapters to this point have stemmed from questions and hypotheses related to communicating adaptation with *vulnerable communities* (following the flood-affected community interviews in *Chapter 3*). The following chapter will look more broadly, at communicating adaptation with the general public. The chapter addresses how health framings of climate change may influence people's engagement with adaptive responses.

Chapter 7

Communicating adaptive responses to the health impacts of climate change: Insights from a nationally representative online survey

7.1 Abstract

Until this point, this thesis has primarily focussed on addressing some of the most salient challenges of communicating adaptive responses to climate change uncovered within vulnerable, flood risk communities in the UK. A key question therefore remains of how to adequately engage the broader UK public with the idea of adapting to climate change impacts. Which types of climate impacts does the broader public feel particularly susceptible to (if not flooding)? How do different styles of communication influence how these threats are perceived, or the extent to which individuals feel able to adopt positive coping responses? This chapter builds on a growing body of work that advocates a public health framing of climate change, by testing responses to such communications. Through a mixed-methods online survey with a nationally representative sample (N=1,004), this chapter provides novel insights into public responses to health-framed climate change communication. It addresses individual-level threat and coping appraisals towards four key climate-based health impacts in the UK (flooding, heat stress, new and emerging diseases and air pollution). Together, the analysis is of the first to consider the socio-cognitive factors that predict behavioural responses to health-framed information and imagery about climate change. The key findings indicated that (1) threat appraisals, efficacy factors and descriptive social norms are strong predictors of adaptive responses to climate change health impacts (2) air pollution and its links with climate change is a particularly salient health issue, according to a range of indicators, and (3) images of 'solutions' are found to evoke a greater sense of efficacy than depictions of health 'impacts'. These results are discussed in relation to qualitative responses in the survey, and the research literature, notably, from health and climate change communications.

Highlights

- After viewing health-framed information, 12.6% of respondents in a nationally representative sample (N=1,004) were more concerned about climate change.
- Air pollution was appraised to be significantly more threatening than three other health impacts (flooding, heat stress and infectious disease).
- Air pollution images were ranked highest in terms of concern, and representativeness of climate change
- Three quarters of respondents (75%) selected air pollution as the issue they felt most able to do something about personally– compared to floods (6%), heat stress (12%), or infectious disease (7%).
- An extended Protection Motivation Theory (PMT) model explained 64% of variance in intended adaptive responses; with climate change concern, threat appraisals, self-efficacy, response-efficacy, response costs, social norms, simulation bias, age and education as significant explanatory factors.

Initial findings were adapted into an online report, published via Climate Outreach (see: McLoughlin & Corner, 2020).

7.2 Introduction: Framing climate change as a health issue

This chapter sets out to do something quite different from the previous chapters. While chapters three to six have addressed research questions that initially stemmed from interviews with flood victims (i.e. people living in particularly vulnerable communities), this chapter considers how to communicate adaptation to the general public in the UK. In other words, this chapter broadly considers: *how can climate change impacts be framed most optimally to encourage adaptive responses amongst the general public?* More specifically, the chapter addresses the potential utility of health framings of climate change, as explained below.

7.2.1 Framing climate change as a health issue

Climate change poses a wide range of impacts to human health globally and in the UK. Impacts on human health include injury and deaths from floods, storms, cyclones and wildfires; microbial proliferation (e.g. salmonella), changes in vector pathogen relations and infectious disease geography and seasonality (e.g. malaria, dengue), impaired crop, livestock and fisheries yield; loss of livelihoods and displacement leading to poverty and adverse health (e.g. mental health, infectious diseases, malnutrition) (McMichael et al., 2006). For such reasons, climate change has been described as the *"biggest global health threat of the 21st century"* (Costello et al., 2009: 1693). In the UK specifically, there are a wide range threats to human health, including flooding, heat stress, food security, disease, air quality and negative outcomes for mental health (CCC, 2017). Given climate mitigation and adaptation actions can deliver a wide range of co-benefits for health, community resilience and poverty alleviation, tackling climate change may also be the *"greatest global health opportunity of the 21st century"* (Watts et al., 2015: 1861). Promoting widespread understanding of the health risks of climate change is now considered to be a crucial aspect of bolstering adaptive responses to climate impacts (Watts et al., 2018).

Despite the health risks of climate change, and the benefits of action, engagement with the health implications of climate change is limited. Research in the U.S. has shown that understanding of health impacts is very limited (Kotcher et al., 2019; Maibach et al., 2015). In the UK, while concern about climate change is high, individuals tend not to believe they are personally vulnerable to impacts of climate change (Abrahamson et al., 2009; Taylor et al., 2014; Wolf et al., 2010). This was shown clearly in a recent national survey in the U.K., where only 14% believed that climate change will harm them personally a great deal, while three quarters (74%) believed that climate change will harm them only a little or a moderate amount, and 12% of respondents said that climate change will not harm them at all (Steentjes et al., 2020). Instead, through research spanning more than a decade, the UK public has been consistently been shown to perceive climate change as geographically distant – primarily impacting places that are far away (Lorenzoni et al., 2006; Steentjes et al., 2020). Tackling the phenomenon of psychological distancing by proximising climate change, and finding ways to do so without backfire effects, is viewed as a key challenge for public engagement with climate change (Brügger, Dessai, et al., 2015; Spence et al., 2012).

In turn, while climate change has predominantly been framed as an *environmental* issue in the past, a growing body of research suggests that re-framing climate change as a public health issue could be particularly effective for public engagement. A public health frame, which emphasises climate change's potential to increase negative health outcomes (such as asthma, infectious diseases, heat stress, and so on), has the potential to increase personal relevance, and reduce the perceived

distance of climate change, by connecting it to already familiar health problems (Nisbet, 2009). In turn, public health framings have been shown to give rise to positive engagement across a broad spectrum of U.S. respondents. In exploratory research, Maibach et al. (2010) found that, after reviewing a short public health-framed essay on climate change, participants responded positively in five out of six segments (where participants were categorised according to prior climate attitudes). In follow up work with a nationally representative U.S. sample, a health frame was shown to increase emotional outcomes that are consistent with adaptive responses, compared to a national security framing (Myers et al., 2012). Importantly, the health frame generated greater feelings of hope than the other frames amongst the most 'Cautious', 'Disengaged' and 'Dismissive' participants. 'Doubtful' participants also reacted most angrily to the national security frame, and least angrily to the health frame. This suggests that a health framing can be both a compelling and less politically polarising approach to communicating climate change – at least in regions such as the U.S., and (to some extent) in the U.K., where climate change remains politically divisive (Leiserowitz et al., 2019; Poortinga et al., 2018).

However, despite promising findings, there is still very little understanding about how to optimise health-framed communication efforts. For instance, there is currently limited understanding of how different climate health impacts are appraised, relative to one another. While flooding has clear health implications, it is plausible that other health issues that are less geographically limited, such as rising infectious diseases, air pollution, or heat stress, will be more engaging. Furthermore, there is poor understanding about what factors might drive behavioural responses when climate is presented as a health risk. Such information would be especially useful for communicators, as interventions could then be tailored to harness the most influential factors associated with positive behavioural outcomes. On this point, as noted in previous chapters, health communications research has consistently shown the importance of *threat appraisal* – for instance, feeling personally vulnerable – in combination with a positive coping appraisal, especially heightened efficacy (Floyd et al., 2000; Witte & Allen, 2000). In addition to threat and efficacy variables, social norms and negative emotion have also been shown to influence adaptive behaviours in meta-analysis (van Valkengoed & Steg, 2019). Thus, it's possible these factors will also influence health impact responses. Given successes in UK health promotion in recent decades, for instance around smoking cessation and healthy eating (Simms, 2018), it seems there is something clear to be gained from treating climate as a health issue, and addressing the factors known to influence health responses.

7.2.2 Health imagery may be a promising route to heightened engagement

In addition to the potential efficacy of health framings, as noted in the literature review, researchers are also increasingly aware of the importance of imagery as an attention grabbing and powerful means of engagement (e.g. Corner, Webster, & Teriete, 2015; O'Neill, Boykoff, Niemeyer, & Day, 2013). However, there is currently a dearth of research linking up these two strands of understanding.

Health-focussed climate imagery might be able to help increase a sense of personal susceptibility to climate change. Past research has found U.K. participants generate dramatic and disastrous mental imagery when thinking of climate change, but tend to associate these images with geographically-distant locations (Lorenzoni & Pidgeon, 2006). This follows frequent visual depictions of political figures in news media (O'Neill, 2013), and common use of visual icons such as polar bears in other

communications (Born, 2019). In turn, given that imagery showing the impacts towards real, relatable people have been found to be particularly resonant with audiences (Chapman et al., 2016), it is possible that imagery focussing on human health may be particularly engaging and motivational. Such imagery may reduce the psychological distance of climate change by increasing perceived personal susceptibility to familiar health problems. Furthermore, health images may influence one's ability to simulate and form a mental image of climate change as a personally relevant concern. This so called 'simulation bias' is likely to play a key role in behavioural responses (Kahneman et al., 1982), and past research has shown ease of imagination occurs more readily when subject matter is framed negatively (Broemer, 2004).

However, there is a need to address a range of gaps related to health imagery first, to ensure effective use in climate communications. For instance, it is not clear what specific characteristics health imagery should have to produce positive engagement. Past research in health communication suggests that depictions of negative health outcomes (such as negative emotional depictions, or graphic imagery) can be particularly motivational, especially when combined with efficacy messages (e.g. Anshari et al., 2018; Thrasher et al., 2011). However, research around climate imagery suggests that negative, fear evoking appeals can produce rebound effects, and maladaptive responses if efficacy is not also nurtured (e.g. O'Neill & Nicholson-Cole, 2009). Additionally, previous research has generally found that images of impacts have salience, but images of solutions tend to evoke efficacy (Metag et al., 2016; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). Assessing these effects in relation to climate change health images would be highly useful evidence for communicators.

7.3 Conceptual framework and hypotheses

The current study aims to address the points raised above, by testing the UK public's responses towards messages that convey information about some of the most pressing climate change health impacts being faced. The study sets out to answer, through both qualitative and statistical insights, how the public engages with information and imagery about climate health impacts; and, to unpick the psychological factors that may predict adaptive behavioural responses, related to such information.

Two key independent variables were identified as being of particular interest for this study, in order to address their relative influence on public engagement: (a) *image content*, and (b) *impact type*. Of primary interest were the effects of certain types of *image content* on behaviour and threat appraisal. To operationalise this, the study drew on research noted above. This research suggests climate imagery is particularly engaging when it shows *real people* (Chapman et al., 2016), and that health warnings which depict *people experiencing negative health outcomes* are effective at persuading audiences to take self-protective behaviours (e.g. Anshari et al., 2018; Thrasher et al., 2011). Bringing these two disparate strands of research together, it therefore is highly plausible that when communicating the health impacts of climate change, (a) images which denote *people* are likely to be more engaging than those which do not (i.e. more effective for promoting positive behaviours, and heightening threat appraisals), and (b) images which show *people in a negative emotional state* may be particularly persuasive. In order to operationalise these

themes and predictions as study variables, the following nominal categories were created as 'image conditions' (no people; neutral people with no notable emotions; and, people with clear negative emotion), which could be tested in relation to a 'text-only' control, with no imagery.

Secondly, given limited research to date has aimed to address how different health *impact types* may evoke different threat and appraisals, this also was a key focus. *Chapter 3* of this thesis suggests that people who have been affected by flooding feel at greater risk of future flooding than the rest of the general public. This suggests that threat appraisals about impacts that are geographically varied in their effects, such as flooding, may be lower compared against other forms of impacts, like heat stress or infectious disease, where an individual could reasonably be susceptible anywhere in the UK.

Therefore, to test how public threat appraisals may differ in relation to different impact types, a selection of four impacts were chosen:

1. Floods
2. Heat stress/heat exhaustion
3. New and emerging infectious diseases
4. Air quality.

This selection balanced several considerations. Firstly, the selection represents four of the most pressing health impacts linked to climate change facing the UK, and thus covered issues of immediate public and policy concern (NERC, 2015). Second, it represents a good spread of impact type, allowing 12 possible pair-wise comparisons to be investigated for significant differences. Third, allowing participants to engage with a good spread of impact type also allows for a more generalisable, conclusive assessment of the influence of condition type. Finally, the impact selection was partly influenced by practical matters relating to the selection of UK-based imagery available at the time of study (see selection of materials below). To summarise the conceptual framework, the main design of the study is illustrated below, with a breakdown of the two independent variables that will be manipulated (*Table 7.3.1*).

Plans to include a fifth impact category focussing on *mental health* was overturned, due to (a) difficulties in finding imagery that clearly denotes mental health as a possible climate related impact, and, (b) difficulties in selecting imagery of mental health for the 'no people' and 'neutral people' conditions. It was decided that given the links between flooding and mental health, this could be conveyed to participants through descriptions of this impact.

Table 7.3:1 *– Summary of the main experimental design with the independent variables 'stimuli type' and 'impact type', each with four levels.*

		Impact type			
		1.Floods	2.Heat Stress	3.Infectious Diseases	4.Air quality
Stimuli type (image conditions)	A) Control (text only)	1A	2A	3A	4A
	B) Image: no people	1B	2B	3B	4B
	C) Image: people + neutral (i.e. no clear emotion).	1C	2C	3C	4C
	D) Image: people + clear display of negative emotion/discomfort	1D	2D	3D	4D

To investigate the key themes and assumptions above, several hypotheses have been devised to build on the past literature about health framings of climate change:

- (H1a) Threat appraisal will be significantly greater in image conditions, compared with the control, and will be highest in the 'people with negative emotion' condition. *(H1b) Flooding will give the lowest average threat appraisal score, which will be significantly lower than disease, heat and air pollution impacts.*

- *(H2a) Negative affect will be significantly higher in the image stimuli conditions, compared with the control, and will be highest in the 'people with negative emotion' condition. (H2b): Heat stress will give the lowest negative affect score, which will be significantly lower than disease, flood and air pollution impacts.*

- *(H3) Adaptive action will be significantly higher in the negative emotion image condition than other treatments, and treatment categories will be higher than the control.*

- *(H4) There will be no significant difference in self-efficacy as an effect of the image conditions (e.g. people vs. no people).*

- *(H5a) Participants' ability to simulate the health impacts of climate change will be significantly higher in the treatment image conditions than the control, with (H5b) participants in the negative emotion condition being most able to simulate health impacts.*

- *(H6) Adaptive action will be significantly predicted by climate change concern, threat appraisal (perceived severity/vulnerability), negative affect, simulation bias, self-efficacy, response-efficacy, costs, descriptive social norms, and political worldview (controlling for age, gender and education).*

- *(H7) Viewing images of solutions will generate significantly greater feelings of self-efficacy than in relation to images of impacts.*

7.4 Methods

An online survey with qualitative, quantitative and experimental components was carried out to investigate how the public engages with imagery depicting climate change health impacts; to gain insights into the public's threat and coping appraisals of health impacts; and to investigate the antecedents of adaptive actions in response to health impacts. The budget for this study was £3,000, which was provided by the *Climate Visuals* project at Climate Outreach; and funded by the KR Foundation.[1]

Participants were recruited online via the survey recruitment platform Prolific.ac (referred to hereon simply as 'Prolific'). Prolific has a large participant pool to which researchers can advertise studies.[2] The online platform allows researchers to advertise online research projects, set payment rates per participation, pre-screen for specific sample characteristics, review participants' responses (allowing the researcher to accept or reject submissions according to the platform's guidelines) and at an additional cost, apply a representative sampling feature within the UK and US. The survey was designed and housed within the online survey platform, Qualtrics.

7.4.1 Ethical approval

Ahead of the placement at Climate Outreach, it was ruled by the Doctoral College in collaboration with the University of Bath Psychology Ethics Panel, that any research conducted during a placement should not require formal ethical approval via the university (see appendix). Given this research study was carried out during the academic placement at Climate Outreach, it was the placement provider's responsibility to ensure the ethical conduct of research. In turn, the study was overseen by the Research Director of the charity. The ethics of the study were informed by BPS ethical guidelines (BPS, 2009, 2018), as well as BPS recommendations of good practice for internet-mediated research (BPS, 2017), as recommended by the University of Bath Psychology Ethics Committee.

Prolific's guidelines for financial incentives and reviewing (e.g. accepting or rejecting participant submissions) were followed carefully, and correspondence was made with Prolific's support team to ensure procedures were correctly followed. All studies must correspond with Prolific's principle of ethical rewards, meaning that participants must receive the equivalent of >£5/hour. All studies conducted on Prolific must be anonymous in nature, meaning that no personally identifiable information can be collected, and all Prolific participants are age 18 or above.

[1] The KR Foundation provides funding for climate change focused projects

[2] According to figures presented in the researcher dashboard within prolific.ac, on the 13th May 2019, Prolific had a sample base of 70,460 globally, of which there were 24,864 participants with a self-reported UK nationality.

Ahead of the survey participants were asked to read over a clear information sheet and required to provide full consent to take part. At the end of the survey, a debriefing sheet provided further details of the study and image credits.

7.4.2 Selection of materials

Given the interest in manipulating visual stimuli within this study, a sound basis for the selection of appropriate imagery was required. Previous visual research has distinguished between two key aspects of engagement with images: *denotative content* (i.e. the objective content – such as a car, tree or river) and the *connotative content* (i.e. the subjective meanings and effects of the imagery, as interpreted by the viewer; O'Neill, 2013, drawing on Dyer, 1982; and Hall, 1973). Denotative aspects of imagery tend to have more stable interpretations, compared to connotative aspects, which are socially and culturally constructed (Rose, 2007). Given this, the denotative dimension of the imagery was adopted as the basis for manipulation. Although not always explicitly stated, this principle has been applied in previous research in which climate relevant imagery is manipulated experimentally, for instance, assessing the effects of showing solar panels or smokestacks on different markers of cognitive engagement (e.g. Hart & Feldman, 2016a).

To provide consistency in the image characteristics, and avoid unwanted confounding influences, some basic rules were adopted (Wessler et al., 2014). All images selected were photographs, of high resolution, with no unusual angles, dimensions or proportions or special effects. To control for the possible influence of psychological distancing effects (e.g. Spence & Pidgeon, 2010), all selected photographs were either taken in the UK, or could reasonably be inferred as being within the UK. Following previous research in the Climate Visuals project (Chapman et al., 2016; Corner et al., 2015), which identifies the importance of showing people in *real* situations (rather than staged photos), an effort was made to ensure the content of the imagery was authentic. However, this aspect was particularly challenging to balance alongside the above rules, while also matching images to the 12 categories of interest. Thus, it is possible that some of the selected imagery could subjectively be viewed as violating the principle of authenticity.

Ahead of the image sourcing, a coding scheme was developed to assist with the selection and categorisation of imagery corresponding with the three condition-levels of ‘image type’ (1. No people, 2. People with no clear denoted emotion, 3. People with clear negative emotion), and four impact types (1. Flooding, 2. Heat, 3. Disease and 4. Air quality). The most relevant pre-existing coding scheme (O’Neill, 2013a) was not found to be suitable for the purpose of selecting imagery for this study. The available codes in these systems did not cover the range of content of interest within the current research design. It did not provide a means for distinguishing between different health impacts of climate change to the level required - such that disease, air quality or flooding could be coded separately. Secondly, while the O’Neill (2013a) structure was more applicable to the content of the images (i.e. people vs, no people), this scheme was not designed to address overlapping categories of denotative content – meaning that, for instance, coding both the presence of ‘flooding’ and ‘people’ is not possible within this scheme. Given that this study required a coding system appropriate for a 3x4 conditions (out of a 4x4 design), a new coding scheme was developed with 12 codes (see below). The underlying methodological principle of pre-existing schemes that *multiple coders are required to ascribe numerical values to specific and clear denotative content of imagery,* was used as the basis for a new, adapted coding scheme.

Table 7.4:1 *- Coding scheme devised for image selection ahead of the survey*

		Impact type			
		1.Floods	2.Heat Stress	3.Infectious Diseases	4.Air quality
Stimuli type (image conditions)	A) Control (text only)	n/a	n/a	n/a	n/a
	B) Image: no people	1	4	7	10
	C) Image: people neutral	2	5	8	11
	D) Image: clear display of negative emotion/discomfort	3	6	9	12

To select images, the lead researcher first selected a long list of 66 images[3] from numerous online sources using relevant search terms for four impact categories and relevant recent events in the UK (see example search terms below). Following challenges securing an initial longlist via Getty images, a similar selection of images for the study were obtained via Adobe Stock[4], as well as images licensed under Creative Commons and allowing reuse, via the Climate Visuals database, Flikr.com and Google Images.

Table 7.4:2 *- Examples of search terms applied during the image search*

Flooding	**Heat stress**	**New and emerging diseases**	**Air quality**
UK Flood	Sun stroke	Mosquito	Air pollution
Storm Desmond	Sunburn	Mosquito bite	Smog
Flooding UK	Heat stroke	West Nile Virus	Smoke
Storm UK rescue	Elderly heat	Lyme Disease	Haze
Flood rescue	Drought	Malaria	Face mask pollution
Storm Desmond rescue	Heatwave health	Fever	London Air pollution
	Wildfire	Illness	UK air pollution
		Person scratching	Air pollution coughing

[3] This figure excludes images 21 images identified as being candidates for a separate 'mental health' category.
[4] Images from Adobe were obtained during a free trial, where 10 images are available under standard licencing. The terms of use are described here under 'Standard License': https://stock.adobe.com/uk/license-terms?prev_url=detail&standard=1&extended=1&enhanced=0&editorial=0#comparison-section

The initial selection was reduced to 12 images, through discussion with the PhD supervisory team, which concerned the clarity of denotative content. Four separate coders (2x PhD students, 1x senior academic and 1x professional working for a climate change communications charity) then reviewed the imagery using the coding scheme. Coders were asked to highlight any images they felt were not addressed by the coding scheme as 'n/a'. Throughout the process coders also were asked for feedback about any problems with the image selection.

Fleiss' kappa was run to determine if there was agreement between the coders' judgement on whether the 12 images matched the codes. According to guidance from Altman, (1990) adapted from Landis & Koch, (1977) there was *very high* agreement between the coders' judgements, $\kappa = .939$, 95% CI [.868, .1.010], $p < .001$. Individual kappa was '1.00' for every separate code, except for the 'disease with neutral people' category and the 'disease and negative emotion' category, which were .746 and .304, respectively.

One image representing 'disease + people with negative emotion' was identified as the source of disagreement in the coding, with two coders suggesting there was no clear negative emotion denoted. Following a thorough online search for a replacement image, several alternatives were identified. The image replacement options were discussed with professionals working in the climate change communications sector at Climate Outreach. While there was one photograph that provided the most obvious alternative for the 'people + negative emotion' category, it was agreed that the image raised unwarranted ethical concerns for the study (given the image showed a child in a state of distress after significant insect bites to their face). The condition 'people + negative emotion' was thus expanded to 'people + negative emotion, distress or discomfort' and a compromise replacement image was selected. Although this image did not show the face of the person depicted, it was agreed that a negative state of distress or discomfort was clearly implied by red skin tones from insect bites to the neck, and the body language of the person depicted.

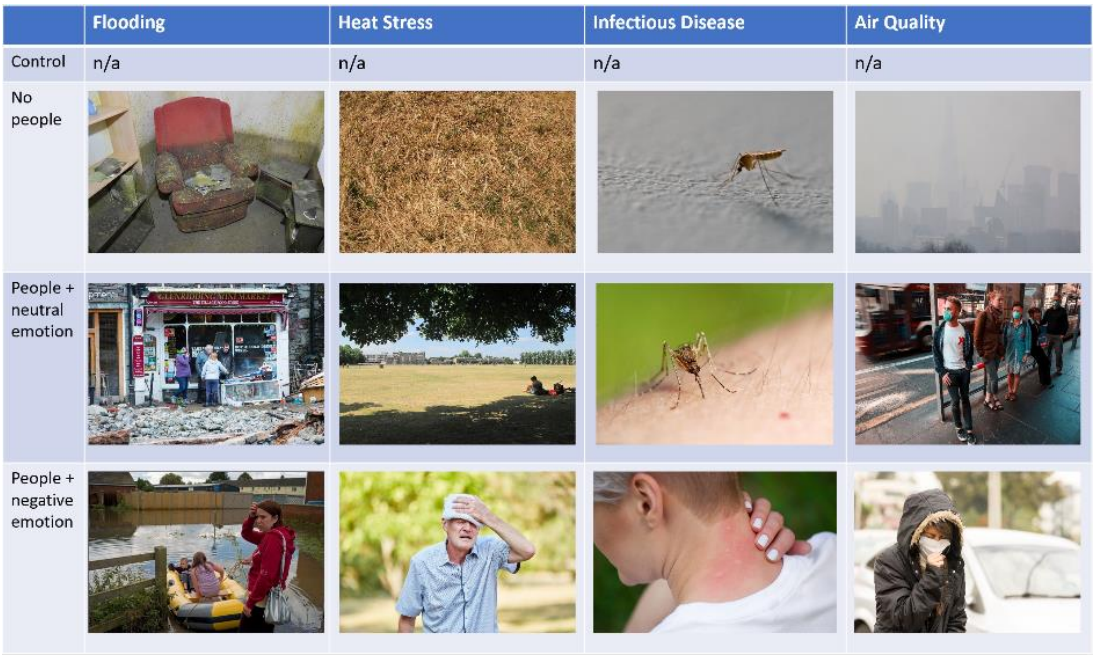


Figure 7.4:1 *- Final image selection with two factors: impact type (columns) and image content type (rows). The control condition had text-only materials, and so its cells are marked as 'not applicable'.*

Textual information about four key UK climate change health risks was reproduced from a research council report synthesising current understanding of health risks from climate change in the UK (NERC, 2015). Information from this report was selected due to its clear, non-technical presentation, which was deemed to be suitable for a public audience. Details of the health risks were purely descriptive, of a similar word count (Range: 55 – 84 words), and level of detail (see *Table 7.4.3*). Upon the suggestion of project collaborators at Climate Outreach, wording in the infectious disease and air pollution descriptions was adapted from the original text, to make it even more accessible to a non-specialist audience. Titles were presented above each summary paragraph in the survey, with a consistent structure ("The health impacts of…") in order to clearly signify the specific issue at hand.

Table 7.4.3 *- Text materials used in the survey to describe UK health impacts relating to climate change*

Flooding	**The health impacts of flooding** Many people will experience climate change through extreme weather. Floods may increase due to increases in heavy rainfall and sea level rise. Some coastal populations will become more at risk of storm surge events. Apart from deaths due to drowning, the most significant health impact from flooding is on mental health, which can persist for many months due to household disruption and displacement.
Heat stress	**The health impacts of heat stress** Climate change will entail hotter summers and more heat waves. Deaths and illness due to very hot weather are likely to increase, and the growing number of older people means more of the population will become vulnerable to hot weather. However, the rate at which a population adapts to higher temperatures is not well understood.

Infectious disease	**The health impacts of infectious diseases** Climate change may affect the risk of emerging infectious diseases. Climate change may increase the risk of new diseases spreading to the UK, alongside other important factors that could also increase this risk (e.g. the movement of people and goods around the world). Native insect and tick species may become more capable of transmitting diseases that affect humans.
Air pollution	**The health impacts of air pollution** Air quality is currently poor in some urban areas of the UK, and climate change may affect the quality of the air we breathe. There are other factors that affect air quality, in some cases more than climate change (e.g. pollution from diesel engines, or from factories). But there may be an increase in certain weather patterns (e.g. heatwaves and 'stagnation' events, where the air does not circulate well), caused by climate change, that amplify the impact of deteriorating air quality caused by pollution.

Textual information detailing a range of adaptive behavioural responses to health impacts was also presented to participants (see *Table 7.4.4*). Descriptions of four key behaviours was based on a recent meta-analysis of adaptation behaviours, which has categorised common behaviours addressed in adaptation-focussed research to date (van Valkengoed & Steg, 2019). The four behaviours were chosen as they could be reasonably be applicable to each of the four impacts in the survey, while other behaviours, such as evacuation or purchasing insurance (though relevant under certain circumstances) were discounted due to being less obviously applicable to the range of impacts described.

Table 7.4:4 *- Text used to describe key adaptive actions that may be taken in response to health impacts associated with climate change*

Now that you have seen information about four impacts related to health and climate change in the UK, we'd like to bring to your attention some actions you might take in response: > Learning more: Taking action to educate yourself further about the health impacts associated with climate change in the UK > Supporting policies: Supporting governmental policies that will help the UK public to prepare for the health impacts of climate change > Preparing: Taking personal actions to prepare for the types of impacts described > Making lifestyle changes: Taking actions to reduce your carbon footprint and combat climate change (e.g. using sustainable transport, reducing household energy use, reducing meat consumption)

7.4.3 Pilot

Following Prolific.ac guidelines, an initial pilot was carried out with 11 participants to establish the likely completion times of the survey. This helped ensure that participant rewards were calculated correctly, and the survey operated smoothly. Prolific uses a

principle of median completion times to assess whether each study underpays participants or not, according to the ethical reward benchmark. Any studies paying the median participant below the ethical reward threshold is required to provide bonus payments to all underpaid participants. Therefore, it was important to be sure that the estimated completion time and incentives were set sensibly.

For the pilot, the median completion time was found to be 16.3mins. For the main study, the estimated completion time was set to 16minutes, with a 26minute maximum time, and reward per participants set at £1.80. Piloting was also carried out with 1x postgraduate student and 2x professionals working in climate change communication, to attain in depth feedback on the survey flow, and identify and necessary amendments to text.

7.4.4 Participants

Participants (N=1,004) with representative quota sampling for age, gender and ethnicity. 986 places were matched on 3 stratification factors (age, sex and ethnicity), and 18 places matched on 2 stratification factors (sex and ethnicity). All participants met English fluency requirements and were listed as being residents in the UK. Out of 1004 places, this gave a sample accuracy of 99.4%. Due to an unexplained case of data loss, one participant had to be removed from all analyses (the total sample size is reported as N=1,003 hereon). Upon completing data collection, the average reward per participant equated to £7.70/hr in the main study.

Table 7.4:5 *- Key descriptive characteristics of the current sample*

Variable	Sample characteristics
Age	M= 44.28 (SD= 15.37)
Gender	Female (50.6%), Male (48.7%), Other (0.7%)
Political views	1-Highly conservative (1.9%), 2, (7.1%), 3 (10.4%), 4-Moderate/middle of the road (38.1%), 5 (19.5%), 6 (15.1), 7-Highly liberal (8.0) [M= 4.43, SD= 1.37]
Urban (e.g. town or city) vs. Rural (e.g. countryside, village)	Urban (72.9%), Rural (27.1%)
Student Status	Non-Student (85.8%), Student (12.9%)
Education Level	No formal qualification (1.4%), Secondary school/GCSE (16.8%), College/A levels (28.6%), Undergraduate degree (37.1%), Graduate degree (13.6%), Doctorate degree (2.5%).
Ethnicity	White (84.0%), Asian (7.7%), Black (3.9%), Mixed (2.5%), Other (1.9%)
Duration of participation (seconds)	M= 760.93 (SD= 301.78)

All percentages reported are 'valid percent', excluding missing data, and thus may not sum to 100%.

7.4.5 Procedure

After reviewing the survey page on Prolific (where basic information about the topic, duration and payment was presented), participants were directed to the Qualtrics survey. All participants were required to review an information sheet and provide consent before participating.

The main experimental component adopted a 4X4 mixed design with one repeated factor of impact type with the levels floods, heat, disease, air quality; and one independent samples factor with the levels control, no people, neutral people and people with negative emotion (see *Table 7.4.6*). At the end of the survey was an additional manipulation with a repeated factor of 'image type' with two levels (impact images vs. solution images).

Table 7.4:6 *- The design of the main experimental manipulation in the survey with number of participants indicated in cells.*

		Impact type [repeated]			
		1.Floods	2.Heat Stress	3.Infectious Diseases	4.Air quality
Stimuli type (image conditions)	A) Control (text only)	248	248	248	248
	B) Image: no people	253	253	253	253
[between groups]	C) Image: people neutral	250	250	250	250
	D) Image: clear display of negative emotion/discomfort	252	252	252	252
	Total	1003	1003	1003	1003

A chronological description of the survey flow is presented in *Table 7.4.7* below. Further details about the measures are presented in the next section.

Table 7.4:7 *- The structure of the current survey, as experienced by each participant.*

Survey Flow
1. Information sheet and consent 2. Climate change concern (pre) and climate change causation (pre) 3. Participants randomly assigned to one of 4 x conditions (control, no people, people + neutral emotion, people + negative emotion). All participants view stimuli relating to each of the 4x impacts (flooding, heat stress, disease, air quality) displayed in random order. 4. After viewing each impact stimuli, participants respond to measures on severity, vulnerability and negative affect. 5. After viewing all impact stimuli, participants respond to the following measures: Select most 'powerful' image (and give reason for choice)*, manipulation checks*, simulation bias

6. All participants saw briefing information about adaptive actions, and then respond to the following questions: adaptive action intentions, self-efficacy, response efficacy, descriptive norms, response costs, climate change concern (post) and climate change causation (post).
7. Forced choice tests
8. Heatmaps (Participants shown one of the 12 impact images at random)
9. All participants shown 4x Impact, and 4x solutions (presented on separate pages, display order randomised). Select most 'effective' image (and give reason for choice), self-efficacy (image focussed)
10. All participants answer self-efficacy (impact)
11. All participants respond to demographics: age, gender, education level, location
12. Debriefing / end of survey

*Questions presented in the image conditions only.

7.4.6 Measures

7.4.6.1 Quantitative measures

Details of quantitative measures used in the study are presented in *Table 7.4.8* below. Measures used in the study were adopted or adapted from previous peer-reviewed studies relevant to climate change adaptation, except for a measure of 'simulation bias', for which a new measure was created.

The simulation bias items were devised to operationalise the key constructs of simulation, as informed by previous research on the topic (Broemer, 2004; Kahneman, Slovic, & Tversky, 1982). Simulation, as understood in this literature, refers to the ease with which events or scenarios can be imagined or mentally construed. The items therefore address the idea of being able to 'form a mental picture of', 'envisage' or 'imagine' the issue or topic of interest; and in this sense, the items have clear face validity. One item in the scale was reversed. The 3-item scale had a very high level of internal consistency, as determined by a Cronbach's alpha of .899, exceeding the '.7' threshold for satisfactory scale reliability cited in the literature (Tavakol & Dennick, 2011).

In general, Likert-scales employed throughout the study were adapted to 7-points, providing consistency of experience for participants. Some questions required a prerequisite of having seen the image stimuli in order to be answered, and therefore were not presented in the text-only control condition.

Table 7.4:8 *- Measures and items*

Construct	Details/Items	Sourced/Adapted from:
Self-efficacy (towards impacts)	*1x item with 4 x choice options: Out of the four UK climate impacts you have learnt about in this study, which do you feel the most able to do something personally about to reduce the risks to you and others where you live?* (1= Flooding, 2= Heatwaves/Heat Stress, 3= Infectious Diseases, 4= Air pollution/Air Quality)	*New item based on self-efficacy measure in:* Hart & Feldman, 2016a)
Climate change concern	1x item with 5 x choice options (Not at all concerned, Not very concerned, Fairly concerned, Very concerned, Don't know)	Captick *et al.* (2015)
Climate change causation	1x item with 7 x choice options (It is entirely caused by natural processes / It is mainly caused by natural processes / It is partly caused by natural processes and partly caused by human activity / It is mainly caused by human activity / It is entirely caused by human activity /There is no such thing as climate change / Don't know).	Captick *et al.* (2015)
Vulnerability	2x items: How vulnerable do you feel about the possibility of a flood affecting you or your family's health (people's health where you live)? Measured on a 7-point scale (1= Not at all vulnerable, 7= Extremely vulnerable)	Adapted from: Martin, Bender, & Raish, 2007)
Severity	2x items: How serious do you feel the negative consequences of flooding are to you personally? / How severe will the impact of a flood be where you live? Measured on a 7-point scale (1= Not at all serious/no harm at all, 7= Extremely serious/extremely devastating)	Adapted from: Martin, Bender, & Raish, 2007)
Negative affect	1 x item: Please summarise your emotional reaction to the information about flooding on the previous page. Measured on a 7-point scale (1= Very positive, 7= Very negative)	*Adapted from a 5-item scale (*Dillard & Shen, 2005)
Self-efficacy towards action	1x item: Personally, I feel able to carry out these actions Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	*Adapted from:* Hart & Feldman, 2016a)
Response-efficacy	2x items: I think these actions would be effective in reducing the negative health impacts of climate change in the UK / These actions would be effective in reducing the risks to people's health posed by climate change in the UK. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	Adapted from: Hart & Feldman, (2016)

Descriptive norms	1x item: Most people like me will take actions to do something about the health impacts of climate change. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	*Adapted from: Lo, 2013)*
Costs	1x item: These actions will have negative consequences. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	*Adapted from:* Floyd, Prentice-Dunn, & Rogers, 2000; Maddux & Rogers, 1983; Rippetoe & Rogers, 1987)
Simulation	3x items: I am able to imagine what the health impacts from climate change look like / I can form a mental picture of the health impacts expected from climate change / I am NOT able to envisage the health impacts associated with climate change [Reversed]. Measured on a 7-point scale (1= Strongly disagree, 7= Strongly agree)	New items (based on: Broemer, 2004; Kahneman et al., 1982)
Adaptive action intentions	4x items: In the next 12 months, how likely or unlikely is it that you will carry out the following actions: Seek further information about the health impacts of climate change that are expected in the UK / Support policies that will help to prepare and protect the UK public from the health impacts of climate change that are expected in the UK / Take actions personally to prepare myself for the health impacts of climate change that are expected in the UK / Adopt a more environmentally friendly lifestyle to help combat climate change (e.g. using sustainable transport, reducing household energy use, reducing meat consumption) Measured on a 7-point scale (1= Very unlikely, 7= Very likely)	Question adapted from Feldman & Hart (2016) to include four key actions described in Valkengoed & Steg (2019)
Self-efficacy (image)	2x items: To what extent do you agree or disagree that the images above: Make me feel personally able to carry out actions in relation to health impacts from climate change / The images above make me feel able to take actions about climate change and health Measured on a 7-point scale (1 - Strongly disagree, 7 – Strongly agree)	*Adapted from:* Hart & Feldman, 2016a)
Political Worldview	1x item: Generally speaking, how best would you describe your political views? Measured on a 7-point scale (1= Very conservative, 4= moderate or middle of the road, 7= Very liberal).	(Feldman & Hart, 2016)

Note: Multi-item variables are represented in the analyses by the mean of their constituent items.

7.4.6.2 Forced choice

There were two forced choice pages in the survey, which presented participants with a single choice from a selection of two out of the twelve impact images, displayed side-by-side at random. Each page of forced choice presented a new random selection of two images, with each page asking participants to respond to a different question. On the first page, participants were asked to choose the most *concerning* image ("Please select the image that makes you feel *most concerned* about the health impacts of climate change"), and on the second, as the most *representative* of climate change ("Please select the image that you think *shows/represents climate change* the most clearly"). The total image choice counts were ordered, giving image rankings of most-to-least concerning and representative of climate change, with a breakdown of impact type and image content type.

7.4.6.3 Heatmaps

For heatmaps, participants were presented with one of the 12 impact images at random, and asked to "Click on the part of the image that grabs your attention the most". Heat maps were then annotated with salient responses from open-ended qualitative data, and weaved into the discussion.

7.4.6.4 Qualitative measures

Participants were asked a selection of qualitative questions throughout the survey, which required responses in text-entry boxes. In the image conditions, after viewing image stimuli and selecting one image that they believed to be the *most powerful*, participants were asked: *"Why is this image the most powerful, in your opinion?".* For the heatmap component of the survey, after clicking on part of an image, participants were asked: *"Please briefly explain why you selected that part of the image".* Following selection of the 'most effective' image from the impact and solution image clusters, participants were asked to *"Please briefly explain how this image makes you feel"*. To prevent issues with a high number of participants being timed out within the survey, and to ensure consistent engagement across the sample, participants were advised that 'a few words to one sentence would be enough' for their response to these qualitative questions.

7.4.6.5 Data analysis

Qualtrics online tools for data analysis and reporting were used to analyse and generate outputs for forced choice ranking data and generate text visualisations and heatmaps. Quantitative data was analysed within IBM SPSS Statistics 25.

Hypothesis testing involved application of several parametric statistical tests (including a two-way mixed Analysis of Variance, one-way ANOVA, Multiple Linear Regression, and T-test). Further details of each respective analysis is presented alongside reporting of results. Post-hoc testing for ANOVA utilised Tukey HSD. Although, as noted by Ruxton & Beauchamp (2008), Tukey sacrifices a degree of statistical power while controlling for type I experimentwise error rate, this test is widely used, and the trade-off between type I and II error is deemed to be satisfactory for the analyses in this study, where several pairwise comparisons are of interest.

Qualitative data was analysed using two methods. Firstly, an inductive thematic analysis was conducted to draw out key themes and subthemes from within the dataset (Braun & Clarke, 2013). Secondly, text visualisations (also known as word clouds) were created from the total responses to each qualitative question. Qualitative findings are presented in the discussion section to illustrate key themes in relation to the statistical analyses.

7.4.6.6 Missing data

All survey responses used in the analysis were fully completed, given that the standard practice via Prolific is to approve completed responses (participants must reach the end of the survey to generate a code which marks their participation as complete). As noted above, there was one case of unexplained data loss within Qualtrics, and this case was deleted from the dataset. Missing data was minimised throughout the survey by prompting participants for responses to unanswered items, through automated messaging in Qualtrics. Where missing data points still existed within the dataset, these were not corrected (e.g. via imputation). This is because such missing responses appear to have been actively and consciously avoided by participants – perhaps to conceal extreme responses. Thus, such values are unlikely to be reasonably estimated by a computational method that would ascribe a seemingly predictable value based on other participants' responses. Missing cases were therefore excluded pairwise in analyses where there was no data available. During the hypothesis testing, this led to one participant being excluded from the regression analysis (N=1,002); 21 were excluded from the ANOVA relating to negative affect (N=982). No data was excluded from the one-way ANOVAs relating to adaptive action, simulation bias, self-efficacy, or the mixed ANOVA relating to threat appraisal score (N=1,003, respectively). The number of valid responses are also reported alongside each separate analysis and descriptive output.

7.4.6.7 Manipulation checks

7.4.6.7.1 People vs. no people

Participants in the three treatment categories (N=755) responded to manipulation checks. In the 'no people' condition, 99.2% correctly answered that no people were shown. In the 'people with neutral emotion' condition, 99.2% correctly said that people were shown. In the 'people with negative emotion' condition, 100% correctly said that people were shown.

7.4.6.7.2 Denoted emotion

Within the 'people with negative emotion' condition, 93.3% correctly stated that negative emotion was depicted in the images. However, in the other two treatment conditions participants were split between saying that negative and neutral emotions were denoted. In the 'no people' condition, 53.4% said that the images were neutral, while 45.5% said that negative emotion was depicted. In the 'people with neutral emotion' condition, 45.2% said that the images were neutral, while 52% said that the images showed negative emotion. This may have been due to (a) around half of participants genuinely picking up on emotional content in the neutral condition, and visa versa in the negative emotion condition; or, (b) that participants misinterpreted what was being asked in the question – with some answering about the denotative content, and others answering about the connotative content. Despite the clarity of the question (which stated "this question is not about how *you feel* but is about what is *shown* in the image"), it is possible that this information was not fully acknowledged by participants moving quickly through the survey. It is not clear which explanation is best supported here. A Chi-Square test confirmed a significant association between condition and choice $\chi(4)= 158.60$, $p <.001$., demonstrating that image differences were generally acknowledged. Nevertheless, responses to the manipulation check still should be considered as indication of a possible limitation to the study, as it is conceivable that manipulation of emotion was not as clear as had been intended.

7.5 Results

7.5.1 Pre and post climate concern

While the pre-test levels of climate change concern was already high (86.4% very/fairly concerned); the proportion of participants in the 'very concerned' category increased from 45.5% (pre) to 53.1% (post), after viewing the materials about the four climate change health impacts. Across the sample, 126 participants (i.e. 12.6% of respondents) expressed increased concern after experiencing the health-framed information. About a quarter (25.3%) of the participants who said they were *not very concerned* about climate change became *fairly or very concerned* after seeing the health messages. In addition, 91 participants who were fairly concerned became *very concerned* about climate change after viewing the health information. Interestingly, 39 participants decreased their level of concern. This possibly indicated some polarisation in responses, or psychological reactance to the information, as found in other studies where participants are asked to appraise climate information (e.g. Ma et al., 2019). However, the reduction in concern was minor across the survey sample, with 2.3% saying they were *not at all concerned* post-test, compared to 1.8% beforehand (a change of just 0.5% overall).

Table 7.5:1 *- Concern about climate change before and after viewing information about four key climate related health impacts in the UK. Green indicates an increase in concern pre-to-post, red indicates a reduction in concern.*

			CC Concern (Pre)					
			Not at all concerned	Not very concerned	Fairly concerned	Very concerned	Don't know	Total (of sample)
CC Concern (Post)	**Not at all concerned**	Count	**15**	8	0	0	0	**23**
		% within CC Concern Pre	**83.3%**	6.8%	0.0%	0.0%	0.0%	**2.3%**
	Not very concerned	Count	**3**	**79**	13	0	0	**95**
		% within CC Concern Pre	**16.7%**	**66.9%**	3.2%	0.0%	0.0%	**9.5%**
	Fairly concerned	Count	0	**27**	**305**	18	1	**351**
		% within CC Concern Pre	0.0%	**22.9%**	**74.4%**	3.9%	100.0%	**35.0%**
	Very concerned	Count	0	**4**	**91**	**438**	0	**533**
		% within CC Concern Pre	0.0%	**3.4%**	**22.2%**	**96.1%**	0.0%	**53.1%**
	Don't know	Count	0	0	1	0	**0**	**1**
		% within CC Concern Pre	0.0%	0.0%	0.2%	0.0%	**0.0%**	**0.1%**
Total (of sample)		**Count**	**18**	**118**	**410**	**456**	**1**	**1003**
		%	**1.8%**	**11.8%**	**40.9%**	**45.5%**	**1.0%**	**100.0%**

7.5.2 Forced choice rankings

The results from the forced choice rankings clearly showed that air pollution imagery was both viewed as the most concerning (the three air pollution images were ranked as the top # 3), and representative of climate change (the top # 2 images were of air pollution). Notably, images of heat stress ranked low in terms of concern (rank 9, 11 and 12), while all three infectious disease images ranked low in terms of being representative of climate change (rank 9, 10 and 11). The role that image characteristics played in these rankings was not clear (i.e. whether the image showed people at all; or people in a negative or neutral state). The same image of air pollution in London, with no people in the frame, ranked top for both lists. However, the rest of the ranking was a mixed field.

Table 7.5:2 *- Results of two forced choice procedures. Participants were asked to select one of two randomly presented images, firstly whichever was most concerning, and secondly whichever was most representative of climate change.*

	Concerning			**Representative of climate change**		
Rank	**Impact**	**Type**	**Count / %**	**Impact**	**Type**	**Count / %**
1	Air Quality	No People	151 (15.31%)	Air Quality	No People	124 (12.5%)
2	Air Quality	Neutral	106 (10.75%)	Air Quality	Negative	109 (11.00%)
3	Air Quality	Negative	101 (10.24%)	Floods	Negative	108 (10.90%)
4	Floods	Negative	96 (9.74%)	Heat	Negative	97 (9.79%)
5	Disease	Neutral	86 (8.72%)	Air Quality	Neutral	96 (9.69%)
6	Floods	No People	80 (8.11%)	Floods	Neutral	90 (9.08%)
7	Floods	Neutral	78 (7.91%)	Heat	No People	89 (8.96%)
8	Disease	Negative	70 (7.10%)	Floods	No People	77 (7.77%)
9	Heat	Negative	68 (6.90%)	Disease	Neutral	57 (5.75%)
10	Disease	No People	62 (6.29%)	Disease	Negative	52 (5.25%)
11	Heat	No People	61 (6.19%)	Disease	No People	50 (5.05%)
12	Heat	Neutral	27 (2.74%)	Heat	Neutral	42 (4.24%)
		Total	**986**		**Total**	**991**

7.5.3 Interactions and main effects of condition and impact type on threat appraisal scores and negative affect

7.5.3.1 Threat appraisal scores

A two-way mixed ANOVA was performed to assess main effects of, and interactions between, condition and impact type on threat appraisal scores (N=1,003). There were no outliers in the data, as assessed by inspection of a boxplot and by examination of studentized residuals for values greater than ±3. The assumption of normality for threat scores was satisfied for all group combinations of impact type and condition, as well as studentized residuals of threat score, as assessed by visual inspection of Normal Q-Q Plots. There was homogeneity of variances, as assessed by Levene's test of homogeneity of variance (p > .05). There was homogeneity of covariances, as assessed by Box's test of equality of covariance matrices (p= .66). Mauchly's test of sphericity indicated that the assumption of sphericity was violated for the two-way interaction, $\chi 2(5)= 86.7$, p <.001. Therefore, the Greenhouse-Geiser scores were interpreted as recommended by (Maxwell & Delaney, 2004).

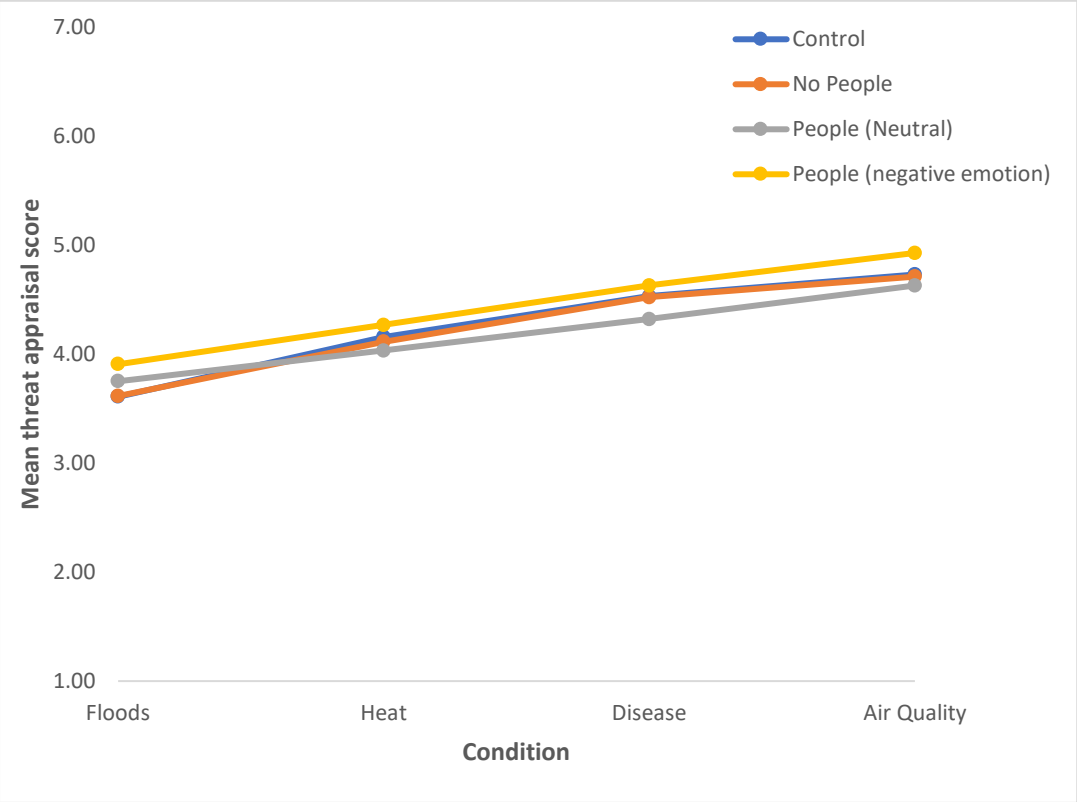


Figure 7.5:1 *- Mean threat appraisal scores by impact type and condition. Mean threat appraisal scores are a composite of perceived vulnerability and severity, which were measured on 7-point scales (see section about 'measures' for details of separate items and scale). Here '7' represents highest perceived threat and '1' represents lowest possible threat appraisal. The chart's X-axis represents impact types (floods, heat, disease and air quality) and separate lines indicate conditions (control, no people, people with neutral emotion, people with clear negative emotion).*

For impact type, as predicted, flooding gave the lowest mean threat score (n=1,003, M= 3.72, SD= 1.69), followed by heat stress (n=1,003 M= 4.14, SD= 1.58), diseases (n=1,003, M= 4.50, SD= 1.49), with poor air quality being viewed as the most threatening (n=1,003, M= 4.75, SD= 1.48). The main effect of impact type showed a statistically significant difference in mean threat score for the different impact categories, F(2.83, 2823.27)= 162.17, *p* <.001, partial η2= .140. Post-hoc investigation revealed that threat scores were significantly different for each impact type, as indicated by pairwise comparisons between each impact type (*p <.001* for all combinations).

There was no statistically significant interaction between the impact type and condition on threat score, F(8.48, 2823.27)= 1.06, *p*= .390, partial η2= .003. The main effect of condition showed that there was no statistically significant difference in mean threat score between intervention groups F(3, 999)= 1.93, *p*= .122, partial η2= .006.

7.5.3.2 Negative affect

A two-way mixed ANOVA was performed to assess the interactions between, and main effects of, condition and impact type on negative affect (N=982). It is unlikely that normality can be achieved when dealing with a one item 7-point scale, therefore investigations for normality were not performed here. The data was checked for outliers, and all responses fell within the expected values of the 7-point scale.

There was homogeneity of variances, as assessed by Levene's test of homogeneity of variance (*p* > .05). There was homogeneity of covariances, as assessed by Box's test of equality of covariance matrices (*p*= .082). Mauchly's test of sphericity indicated that the assumption of sphericity was violated for the two-way interaction, χ2(5)= 12.841, *p*= .025. As with above, the Greenhouse-Geiser scores were interpreted as recommended by (Maxwell et al., 2004).

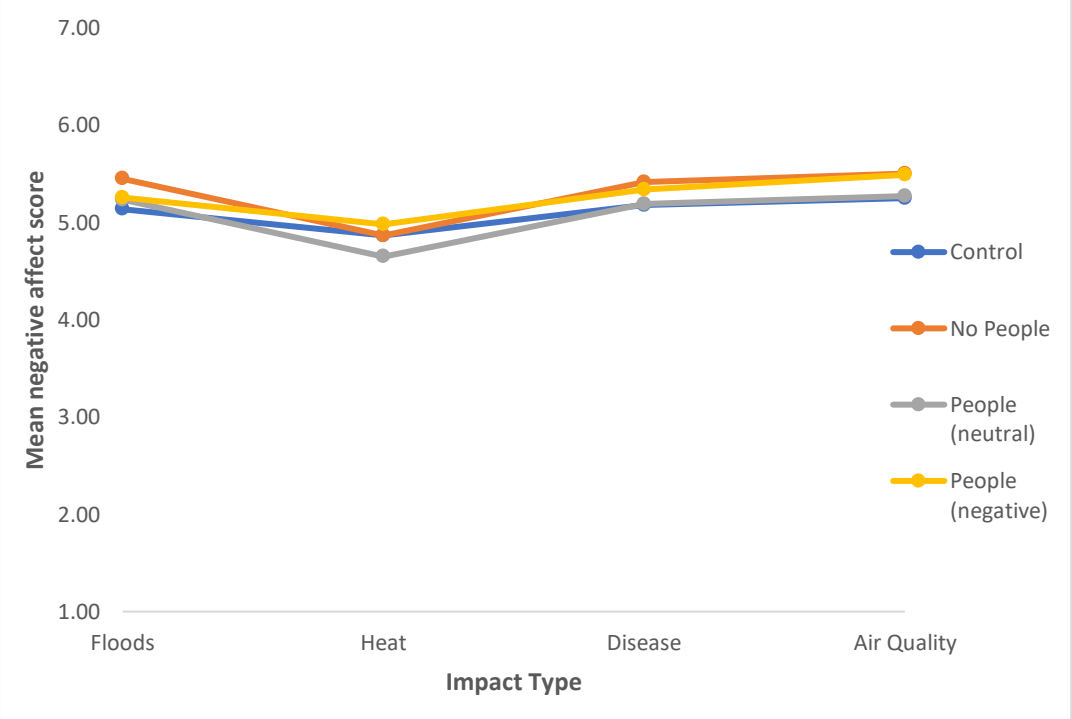


Figure 7.5:2 *- Mean negative affect scores by impact type and condition. Here a score of '7' represents highest negativity, and '1' represents least negativity.*

There was a statistically significant interaction between the condition and impact type on negative affect score, F(8.92, 2907.6)= 1.921, *p*= .045, partial η2= .006. To investigate these interactions, post-hoc tests were carried out by employing separate univariate ANOVAs. The findings of this post-hoc testing are presented below.

Flooding

There was a statistically significant difference in negative affect around flooding due to condition type, F(3, 999)= 2.84, *p*= .037, partial η2= .008. A Tukey Post-Hoc test showed that negative affect was significantly lower in the control (n=248, M= 5.14, SD=.1.27 , *p*= .024) than the 'no-people' treatment group (n=253, M= 5.45, SD= 1.24). There were no other significant differences between the conditions.

Heat

There was a statistically significant difference in negative affect around heat stress due to condition type, F(3, 999)= 3.01, *p*= .029, partial η2= .009. A Tukey Post-Hoc test showed that negative affect was significantly higher for the 'people with negative emotion' condition (n=252, M= 4.98, SD= 1.31, *p*= .018) than the 'neutral people' treatment group (M= 4.65 , SD= 1.22). There were no other significant differences between the conditions.

Disease

There was no statistically significant difference in negative affect around disease due to condition type, F(3, 999)= 2.26, *p*= .080, partial η2= .007.

Air Quality

There was a statistically significant difference in negative affect around poor air quality due to condition type, F(3, 978)= 2.94, *p*= .032, partial η2= .009. A Tukey post-hoc test was inconclusive, showing no significant differences between the conditions. Considering the small effect size and relatively large p-value, not much confidence should be placed in this effect.

7.5.4 Between-groups tests for differences in adaptive action, self-efficacy and simulation bias as an effect of condition

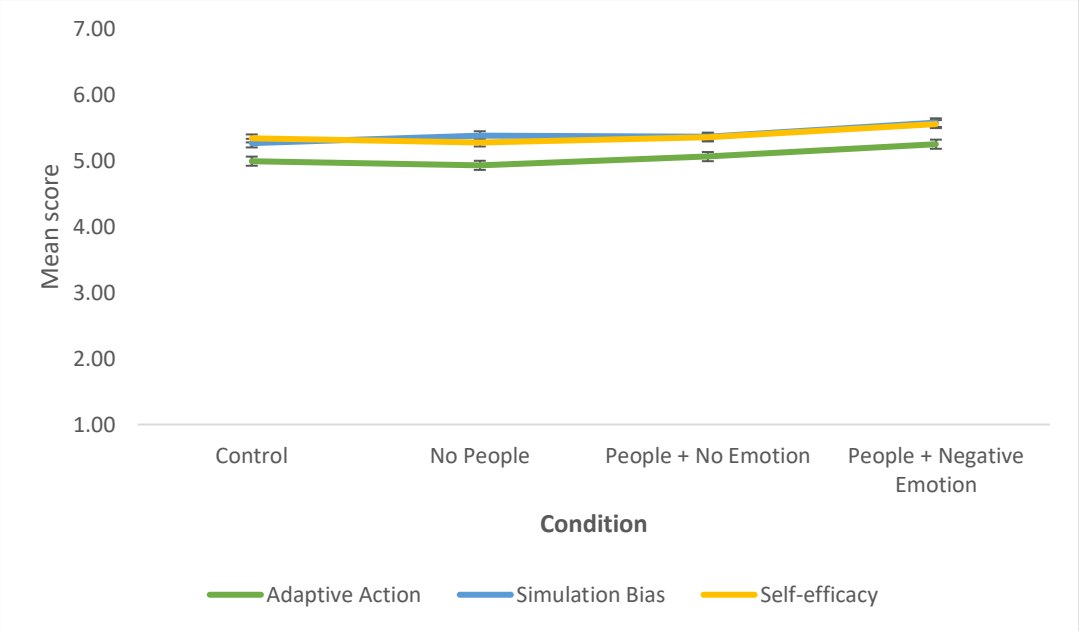


Figure 7.5:3 *- The influence of condition on adaptive action, self-efficacy and simulation bias scores (this graph shows the raw data scores rather than the ranked data). With each measure '1' represents the lowest score and '7' the highest.*

7.5.4.1 Adaptive action

A one-way ANOVA on ranked data[5] was carried out to assess if there were significant differences in mean ranks of adaptive action scores between the conditions (N=1,003). There was homogeneity of variances, as assessed by Levene's test for equality of variances (*p*= .811). The adaptive actions mean rank was lowest in the 'No People' group (n=253, M= 474.56 , SD= 286.00), and increased to the Control, (n=248, M= 495.55, SD= 293.88), then 'Neutral People' (n=250, M= 497.57, SD= 286.31) to 'People with Negative Emotion' (n=252, M= 540.26, SD= 288.41) in that order. However, these differences were not statistically significant, F(3, 999)= 2.30, *p*= .076, η2=.007.

7.5.4.2 Self-efficacy

A one-way ANOVA on ranked data was carried out to assess if there were significant differences in mean ranks of self-efficacy scores between the conditions (N=1,003). There was homogeneity of variances, as assessed by Levene's test for equality of variances (*p*= .584). The self-efficacy mean rank was lowest in the 'No People' group (n=253, M= 482.00, SD= 281.60), and increased to the control, (n=248, M= 491.40,

[5] Ranked data was analysed to deal with the somewhat positively skewed distributions of outcome variables in the analyses of adaptive action, and simulation bias scores, as assessed through observation of normal Q-Q plots. The ranked data was reasonably fine grained, with 25x levels for adaptive action, 19 x levels of respondents for simulation bias. Self-efficacy was normally distributed. This was a single item measure, and therefore the ranking did not change the number of response levels (1-7). Nevertheless, this ranked data was still analysed for consistency with the other analyses.

SD= 283.30), then ‘Neutral People’ (n=250, M= 492.91, SD= 280.20) to ‘People with Negative Emotion’ (n=252, M= 541.53, SD= 270.67) in that order. However, these differences were not statistically significant, F(3, 999)= 2.33, *p*= .073, η2=.007.

7.5.4.3 Simulation

A one-way ANOVA on ranked data was carried out to assess if there were significant differences in mean ranks of simulation bias scores between the conditions (N=1,003). There was homogeneity of variances, as assessed by Levene's test for equality of variances (*p*= .071). From lowest to highest, the simulation bias score was lowest in the control group (n=248, M= 459.71, SD= 265.66), then ‘Neutral People’ (n=250, M= 489.10, SD= 287.31), higher for ‘No People’ (n=253, M= 499.30, SD= 295.10), and highest in the ‘People with Negative Emotion’ group (n=252, M= 559.15, SD= 293.23). There was a statistically significant difference in simulation bias scores between the different conditions, F(3, 999)= 5.34, *p*= .001, η2=.016. A Tukey post hoc analysis revealed that the mean difference between ‘People with Negative Emotion’ condition and the Control (99.44, 95% CI [33.64, 165.24]) was statistically significant (*p*= .001), and the mean difference between ‘People with Negative Emotion’ condition and the ‘Neutral People’ condition (70.06, 95% CI [4.439, 135.72]), was statistically significant (*p*= .031).

7.5.5 Regression analysis

A multiple regression was run to predict adaptive action intention from climate concern, perceived vulnerability, perceived severity, negative affect, simulation bias, self-efficacy, response-efficacy, response costs, age, gender, education and political views (N=1,002).[6]

Perceived vulnerability and perceived severity were found to be highly correlated (.89), and so a mean score was computed from the two variables and entered into the model as a combined ‘threat appraisal score’ - aligning with the theoretical assumptions of Roger’s PMT model (Floyd et al., 2000; Maddux & Rogers, 1983; Rippetoe & Rogers, 1987). For this analysis, the post-test climate change concern scores were utilised – in order to take into account any influence of the experimental stimuli on concern. Participants who answered ‘don’t know’ for this were recorded as missing data. To fit the model, non-significant predictor variables were removed in order of highest to lowest p-value. Gender was removed first (*p*= .935), followed by negative affect (*p*= .132), followed by political views (*p*= .114).[7]

The dependent variable residuals were normally distributed as assess through inspection of a histogram and a normal P-P plot of standardized residuals. There was independence of residuals, as assessed by a Durbin-Watson statistic of 2.039. There was a linear relationship between the dependent variable and the collective independent variables, and homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. Each independent, continuous variable was linearly related to the dependent variable, as assessed through partial regression plots. There was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There were no issues of collinearity observed, with all correlations between independent variables <0.7 and with the a maximum VIF

[6] Number of valid participants reported here corresponds with the final model output of this analysis.
[7] *p*-values reported at the point of removal, respectively.

value of 1.79 (Hair et al., 2014). Nine possible outliers were detected by inspection of studentized deleted residuals for values ±3 standard deviations. However, no cases were found to exhibit high leverage, with all centred leverage values <0.2, which is considered safe (Huber, 1981). There were no problematic cases in terms of influence, as assessed by inspection of Cooks Distance values, which were all <1 (Cook and Weisberg, 1982). Therefore, no data was removed from the model.

R^2 for the overall model was 0.64 with an adjusted R^2 of 0.64, a large size effect according to Cohen (1988). Climate change concern, threat appraisal, simulation bias, self-efficacy, response efficacy, descriptive norms, response costs, age and education statistically significantly predicted adaptive action intentions F(9, 991)= 198.34, *p* <.001. Regression coefficients and standard errors can be found in *Table 7.5.3* (below).

Table 7.5:3 *- Summary of linear regression analysis for variables predicting adaptive action intention in response to climate health impacts in the UK (N=1,002)*

Variable	*B*	*SE B*	*β*
(Constant)	-1.224	0.234	
Climate Change Concern	0.600	0.047	0.326***
Threat Appraisal (Vulnerability/Severity)	0.264	0.027	0.234***
Simulation Bias	0.051	0.026	0.042*
Response Efficacy	0.146	0.027	0.135***
Self-Efficacy	0.224	0.027	0.199***
Descriptive Norms	0.110	0.021	0.119***
Response Costs	-0.046	0.021	-0.045*
Age	0.006	0.002	0.071***
Education	0.073	0.026	0.055**
R^2		.64	
F		198.34***	

*p < .05., **p < .01., *** p < .001

7.5.5.1 Self-efficacy: Impacts versus solution images

To understand the influence of different image content on feelings of self-efficacy, 1,003 participants responded to questions about their perceived self-efficacy in relation to clusters of four impact images, and four solution images (all matched in showing people with neutral emotion). A paired-samples t-test was used to determine whether there was a statistically significant mean difference between self-efficacy scores related to the impact and solution images. Several outliers were detected that were more than 1.5 box-lengths from the edge of the box in a boxplot. Inspection of their values did not reveal them to be extreme, or unexpected values, and they were kept in the analysis. The assumption of normality was not violated, as assessed by inspection of a histogram with a superimposed normal curve, as well as Normal Q-Q plots. Participants reported higher levels of self-efficacy scores in relation to solution images (M= 4.97, SD= 1.34) as opposed to the impact images (M= 4.65, SD=1.44), a statistically significant mean increase of 0.32, 95% CI [0.25, 0.40], t(1,003)= 8.48, p <.001, d= 0.27. Further investigation revealed that of the 1,004 participants recruited to the study, the solution images elicited an increase in self-efficacy for 375 participants compared to the impact images, while there were no changes in self-efficacy for 442, and self-efficacy was lower in response to the solution images for 186 participants.

7.5.6 Summary of hypothesis testing

A summary of the hypothesis testing in this chapter is provided below, with details of predictions and outcomes.

Table 7.5:4 *- Summary of hypothesis testing*

Hypothesis		Outcome
H1	(H1a) Threat appraisal will be significantly greater in image conditions, compared with control, and will be highest in the 'people with negative emotion' condition.	*Not supported*
	(H1b) Flooding will give the lowest average threat appraisal score, which will be significantly lower than disease, heat and air pollution impacts.	*Supported*
H2	*(H2a) Negative affect will be significantly higher in the image stimuli conditions, compared with control, and will be highest in the 'people with negative emotion' condition.*	*Not supported (there was an interaction effect, rather than a main effect of condition)*
	(H2b): Heat stress will give the lowest negative affect score, which will be significantly lower than disease, heat and air pollution impacts.	*Not supported (heat stress had the lowest negative affect score on average, but there was an interaction effect rather than a main effect)*
H3	*Adaptive action will be significantly higher in the negative emotion image condition than other treatments, and treatment categories will be higher than control.*	*Not supported*
H4	*There will be no significant difference in self-efficacy as an effect of the image conditions (e.g. people vs. no people)*	*Supported*

H5	*(H5a) Participants' ability to simulate the health impacts of climate change will be significantly higher in the treatment conditions than the control*	*Partially supported (there was a significant difference between the negative emotion vs. control; and negative emotion vs. neutral people)*
	(H5b) participants in the negative emotion condition will be most able to simulate health impacts.	*Supported (as above)*
H6	*(H6) Adaptive action will be significantly predicted by climate change concern, threat appraisal (perceived severity/vulnerability), negative affect, simulation bias, self-efficacy, response-efficacy, costs, descriptive social norms, and political worldview (controlling for age, gender and education)* .	*Partially supported (all significant except negative affect, political views and gender)*
H7	*(H7) Viewing images of solutions will generate significantly greater feelings of self-efficacy than in relation to images of impacts.*	*Supported*

7.6 Discussion

7.6.1 Key finding 1: Threat appraisals, efficacy and social norms strongly predict adaptive responses to health impacts

While past research has suggested that public health framings could be an effective way to engage the public with climate change, this analysis adds further insights into why that might be, and how to communicate health impacts effectively. Concern about climate change was shown to increase for the very concerned category pre-to-post from 45.0% pre-test, to 53.1% post-test, with 126 participants (i.e. 12.6% of respondents) expressing increased concern after experiencing the health-framed information. About a quarter (25.3%) of the participants who said they were *not very concerned* about climate change became *fairly or very concerned* after seeing the health messages. This clearly shows that health-framed information can directly increase concern, even for those who are not worried about climate change beforehand. This highlights that health-framed messages can have an immediate impact on the general public's concern about climate change.

The regression analysis presented above is of the first to consider which factors specifically predict behavioural responses to the health impacts of climate change. The analysis identifies the importance of threat appraisal factors (climate change concern, perceived vulnerability/severity) and coping appraisals (self-efficacy and response efficacy), as well as descriptive social norms. These factors were each highly significant, and explained higher amounts of variance in adaptive responses, relative to other factors considered. This suggests that communications should highlight vulnerability and severity; but crucially should match this by building a sense of self and response efficacy and communicating where there are positive descriptive social norms. Other structural interventions should also address these factors where possible (for instance, ensuring health response options are easy and effective).

The work shows that Protection Motivation Theory, adapted to include additional factors, like descriptive social norms, can be highly explanatory – in this case explaining 64% of variance in adaptive responses to climate health impacts. This

further validates suggestions (and attempts) to apply and adapt PMT, as seen in other research related to adaptation (e.g. Grothmann & Patt, 2005; van Valkengoed & Steg, 2019). The research also suggests that models like PMT, which are commonly used in health psychology, can be suitably applied to health issues related to climate change, given a similar balance of threat and efficacy influences have been shown in meta-analyses related to health communications (Floyd et al., 2000; Witte & Allen, 2000).

In addition, this study highlighted some factors which did not significantly predict adaptive action. Firstly, in contrast with Van Valkengoed and Steg (2019), *negative affect* was not found to be a significant predictor in the regression model. This may be explained by the Protection Motivation model, which considers negative emotional responses to be a biproduct, rather than a direct predictor of adaptive action. Alternately, it is possible that Van Valkengoed and Steg (2019) find a greater influence for negative affect across the studies they reviewed as they include measures of 'climate change concern' in their analyses as a form of negative affect, rather than as a threat appraisal as done in the present work. Secondly, *political worldview* was not a significant predictor in the regression presented in this chapter. This is very interesting, and builds on work suggesting that health-framed climate engagement cuts through typical political polarisation around climate change (Myers et al., 2012). This adds weight to research and commentary which suggests that mitigation behaviour involves an influence of values, but behaviour about adapting to impacts does not (Kahan, 2013; Zhang et al., 2020). This contrasts with research suggesting mitigation and adaptation are 'hand in hand' in terms of cognitive processing (Brügger, Morton, et al., 2015). Together this suggests that when threat, efficacy and social norms are made salient, health framings can increase adaptive responses to climate change without priming political values-based responses.

7.6.2 Key finding 2: Air pollution is a promising focus for health-framed climate engagement

The findings presented here suggest that focussing on the health impacts of air pollution, and its links to climate change, could be a particularly engaging issue to base communications around. Air pollution was consistently shown across the analyses to be more engaging than the three other issues considered (heat stress, flooding and new and emerging infectious diseases). Air pollution elicited significantly higher threat appraisals (perceived vulnerability/severity) and negative affect. Images of air pollution were also ranked as being more concerning and representative of climate change. Crucially, in addition to this, people's sense of efficacy in order to be able to address this issue was suggested to be higher, as three quarters (74.9%) of participants selected this issue as the one they felt most able to do something about personally (see *Figure 7.6.1* below). Given the balance between threat and efficacy was shown to be important in the regression analysis also, the alignment of favourable cognitive factors in relation to air pollution suggests this is an ideal impact framing around which climate-relevant campaigns and communications can be based.

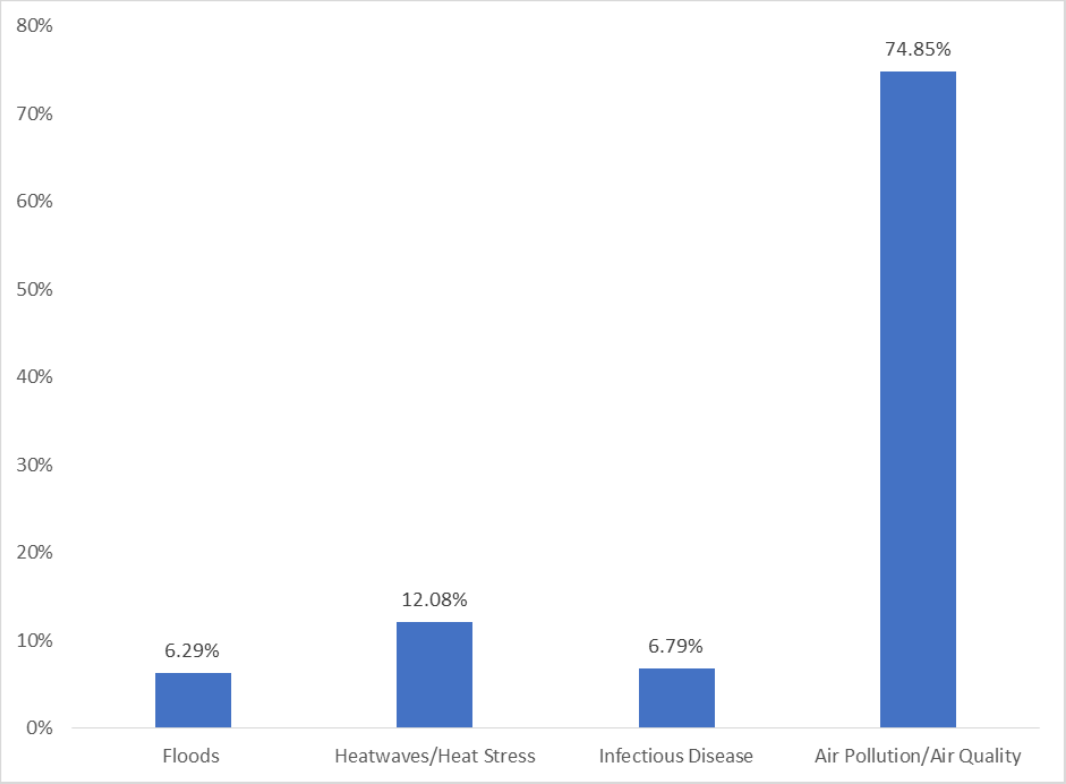


Figure 7.6:1 *- Participants' perceived self-efficacy in relation to four key health impacts posed by climate change (N=1,003). The question asked: "Out of the four UK climate impacts you have learnt about in this study, which do you feel the most able to do something personally about to reduce the risks to you and others where you live?" The chart illustrates the percentage of participants who selected each impact.*

The salience of air pollution over the other issues fits with other research. For instance, Whitmarsh (2008) found that individuals who had experienced air pollution were more likely to perceive climate change to be a salient risk and respond adaptively, than individuals who had experienced flooding. While the air pollution victims were no more likely to cite pollution as a cause of climate change than non-victims, they were found to have higher pro-environmental values consistent with adaptive behavioural responses. Additionally, when considering framings of emissions, Hart & Feldman (2018) found that an air pollution framing increased support for government action, both directly and indirectly (via belief in negative impacts), compared against a climate change framing. The scholars conclude that communications are likely to be more successful in increasing policy support by focusing on 'non-climate change risks' that the pollution poses, rather than linking the pollution to climate change. The present chapter is consistent with these studies, and builds on this further by suggesting that information and imagery that *directly links* air pollution with climate change is also more likely to produce a sense of personal threat, concern, and efficacy; than flooding, heat stress and disease-focussed health messages.

However, the findings contrasts somewhat with a recent national survey of UK respondents about risk perceptions and adaptation (Steentjes et al., 2020). The Resil-Risk survey found that flooding, coastal erosion and heavy storms were appraised as being the most serious problems in the U.K. - with 90% of respondents

saying flooding was a fairly or very serious problem (the highest across the issues presented). Additionally, the survey reported high concern around heat stress, with 72% saying that both heatwaves and dry periods present a fairly or very serious problem in the UK. The authors note that this represents a substantial increase in concern around U.K. heat in recent years, given just 23% believed heatwaves were *fairly or very serious* in a comparable 2013 survey. Steenjes and colleagues did not directly compare responses to air pollution, or new and emerging diseases, so it is not possible to check if these were appraised as more concerning impacts (as found in the present work). Nevertheless, in an additional survey question they reported, participants were asked to describe the most important effects of climate change in the UK and locally, via open text response. The three most popular types of responses concerned weather – noting increases wetter weather, more storms, rain, or flooding (16%), increased unpredictability of weather (14%) and hotter and drier weather with more heatwaves and droughts (13%). Very few participants mentioned 'pollution' as an issue (6%), or health (just 1%).

It is difficult to explain the discrepancies of these results. One possible explanation concerning divergent appraisals of heat stress was that data collection for Resil-Risk was conducted in October 2019, following three unprecedented heatwaves during 2019. These events led to a new record high U.K temperature, and almost 900 excess deaths (Carrington, 2020). Given people's direct experience of these weather extremes, and media coverage, an availability bias cognitive heuristic, whereby recent salient information implicates perceptions, could have substantially altered perceived risks of heat stress (see: Clayton et al., 2015; Gifford, 2011; Kahneman et al., 1982). In terms of the divergent different risk perceptions around 'pollution' risks between the studies – this may be down to differences in the way information and questions were framed in the surveys. The present study made links between climate change and air pollution ahead of questions – and specifically asked for appraisals of air pollution – whereas the Resil-Risk project allowed participants to state any issue they felt was concerning. It might be therefore that Resil-Risk respondents did not perceive air pollution to be relevant to the line of questioning. In addition, the Resil-Risk project asked participants about what they felt to be serious for the UK as a whole, while the present study asked about perceived *personal* vulnerability/severity. The measurement scales applied in questioning are also not directly comparable.

Nevertheless, given the apparent discrepancies and the clear salience of air pollution over other issues in the present survey, to further investigate this, qualitative responses in the present survey can be assessed in more detail. This is discussed next.

7.6.2.1 Explaining why air pollution was the most engaging issue

Why was air pollution appraised as being the most salient issue in the present survey? Themes uncovered through the qualitative responses in the data provides some interesting lines of explanation. These explanations include (1) *universal vulnerability* (2) *air as a basic need* and (3) *resonance with past experiences.*

First, air pollution generally appeared to be distinguished from the impacts in that it could affect anyone in the UK – not just a sub-sample of the population. Several quotes in responds noted how they felt anyone in the UK was vulnerable to air pollution, while only certain people were vulnerable to the other issues, like flooding (see *Table 7.6.1*). In other words, air pollution impacts were viewed as being

inescapable. This helps explain the saliency of air pollution in the quantitative responses, and makes sense in light of the PMT model. PMT explains that for an issue to be viewed as a salient threat, individuals must perceive a degree of personal vulnerability (Maddux & Rogers, 1983; Rogers, 1975). The results of the statistical analyses showed that air pollution scored significantly higher than the other issues in terms of threat appraisal (which combines vulnerability with severity measures). This explanation gains extra credibility given that even participants who did not see air pollution being the most salient issue also drew on universal vulnerability explanations. One respondent, for instance, noted that disease was most concerning because:

> "*It's personal. Anyone can be bitten by an insect, insects travel continents. Floods, air pollution and heatwaves affect isolated communities".*

Nevertheless, most qualitative responses indicated that people felt air pollution was closer to home – affecting people in developed western countries, like the UK. This suggests that perceived vulnerability to air pollution can reduce the psychological distancing often associated with climate change and counters the "othering" of climate impacts to remote people and places.

Table 7.6:1 *- Quotes about personal vulnerability*

"Flood, diseases and heatwave might affect some area or some vulnerable people, but air pollution is more serious it affects all of us."
"Living in a massive city like Birmingham, had this picture impact me the most. The use of masks highlights how bad the issue is"
"It will affect everyone no matter where they live or work."
"Air pollution affects us all, normal people in the western world. The picture clearly identifies with my thoughts on it."
"I think that air pollution is the most serious one because it would affect everyone indiscriminately. There is no way to avoid it, there is no element of luck involved - for example, with a flood, not every house would be affected etc."

A second explanation suggests that air pollution was salient because it represents a threat towards a basic need *(Table 7.6.2).* The idea that a basic human need, such as the air we breathe, can be affected or taken away appeared to be particularly resonant with participants when asked about what makes imagery powerful (see box below). This *basic needs* explanation fits with Maslow's famous 'hierarchy of needs' model, which suggests that physiological needs (e.g. air, food and water) are the most essential for any individuals to satisfy, ahead of safety needs, and psychological needs (Maslow, 1943). In turn, it makes sense that if a climate threat potentially inhibits a physiological need, then it will be viewed as especially concerning. The hierarchy of needs model has been applied qualitatively to explain responses to climate hazards like sea level rise (Graham et al., 2013) and in light of the present findings, warrants further consideration perhaps through quantitative or experimental work.

Table 7.6:2 *- Quotes about basic human needs*

"air is such a basic need, being unable to breathe is terrifying."
"because we all need to breathe and polluted air will bring about issues and diseases"
"we all need to breathe air. It's one of the few things that will affect everybody"
"the other images focus more on external impact[s] whereas breathing is internal"
"everyone has to breathe to live and pollution [in the] air can cause all sorts of diseases."

This explanation also seems to fit with the past research, where US citizens have noted high level of concerns about air pollution, but were not able to name specific health conditions that will result. Kotcher et al., (2019) report in a nationally representative survey in the U.S. that a substantial majority of Americans (73%) were aware that air pollution from the use of fossil fuels harms human health, but only about half (55%) were able to name even one specific health impact, and those who did could only name general issues (e.g., breathing problems, respiratory illness) rather than specific issues (e.g. asthma). This suggests appraisal of air pollution might not be at a rational/cognitive level where specific health concerns are in mind – but more likely at an immediate level about ensuring the basic physiological need to breathe. However, there is some contrast with other work by the same authors which found that that impacts to brain development were viewed as the most concerning impacts of air pollution from burning fossil fuels in the U.S – more so than impacts associated with breathing, like asthma and other respiratory illnesses (Kotcher et al., 2019).[8]

Despite the above, there was also evidence in the survey that air pollution (and the other impacts) were particularly resonant when participants had pre-existing health concerns *(Table 7.6.3).* This explanation makes sense in light of research which draws on the importance of direct experience for threat appraisals around air pollution (e.g. Whitmarsh, 2008), and other work highlighting a positive influence of direct hazard experiences on attitudes and behavioural responses (e.g. Działek et al., 2016; Elrick-Barr et al., 2016; Parkhill et al., 2013; Spence et al., 2011). Nevertheless, this explanation is not likely to have been prevalent throughout the dataset – and is not likely to have influenced risk perceptions where respiratory issues had not been experienced by respondents previously.

[8] The specific statement that was ranked as most concerning was: *"Air pollution and toxic chemicals released when fossil fuels are burned can cause delays in development, reduced IQ, attention deficits, learning difficulties, behavioral problems, and autism in babies and children, even when the exposure occurs before birth"*

Table 7.6:3 *- Quotes about past personal experiences*

"I am asthmatic, and already struggle to breathe right, pollution levels increasing would drastically affect me."
"I have 3 people in my family with asthma and breathing is a top issue for me."
"I seem to be singled out to pick up infections. I get cold sores, had impetigo many years ago, was hospitalised with cellulitis for a weak and had ringworm as a child, they give me the creeps and I take it personally"
"Because it has happened to me! My home and the area was flooded in 2008, it seriously affected my health as I developed 'spores' on my lungs from the damp. I was out of my own for home for over 2 years and this also affected my mental health."

In addition to the above, a few other explanations that were not directly apparent in participant responses also make sense in light of other research. As discussed earlier, it might be an effect of (4) *simulation bias* – given that air pollution is a particularly visual issue – arguably more so than heat stress, flooding and diseases. This explanation may be contested however, given previous research has found that noticing increases in flooding was given as the top reason for increased concern about climate change in one national survey (Capstick, Demski, et al., 2015). There may also have been an influence of (5) *availability bias* – given that in recent years, the health impacts of air pollution have been increasingly conveyed in media discourses. Finally, there may be an interesting effect related to (6) *construal level*. Construal Level Theory (CLT), broadly attempts to explain the influences of abstractness or concreteness of people's thinking (for instance, in terms of temporal, and spatial distance) on other psychological outcomes (Trope & Liberman, 2010). It seems plausible that a specific *cause and effect* construal phenomenon was at play. Air pollution impacts may be simpler to understand and more salient because the chain of cause and effect is potentially less complicated than the other issues considered. For instance, the chain of cause and effect concerning how *fossil fuel consumption can lead to changes in flooding* is seemingly more complex and nuanced than that of *car use directly increasing air pollution*. Though distinct, this explanation fits with one study which found air pollution is typically understood in terms of the immediate physical, social and cultural landscape – referred to as 'localisation' (Bickerstaff & Walker, 2001). However, if this explanation holds true, this would mean that the survey participants were considering air pollution predominantly as a localised, perhaps even wholly 'non-climate change' issue, rather than linked to climate change (i.e. increases in stagnation events). Further research should therefore address these explanations, ideally via robust quantitative work.

7.6.3 Key finding 3: Balancing the communication of impacts to people using solution-focused imagery

While focussing on a specific impact like air pollution may be a particularly effective way to heighten engagement with climate change in the UK, imagery produced interesting responses too, showing its importance for engagement.

7.6.3.1 Distinct responses to 'solution' versus 'impact' imagery

The clearest causal effect of imagery presented in this research is that images of impacts and solutions catalyse significantly different beliefs about self-efficacy. The study showed that 375 participants reported higher self-efficacy after viewing solution images, compared to responses to impact imagery (see results section). In addition to this, qualitative responses to the two types of image clusters – impacts and solutions - showed notably distinct discourse in relation to impact versus solution imagery (see *Figure 7.6.2*). While both image clusters elicited 'people' as the highest used word, textual responses to the impact images evoked words like 'air', 'mask' and 'pollution', and words of negative valence like 'concerned', 'scary' and 'sad'; while the solution imagery evoked words such as 'positive', change and action.

Figure 7.6:2 *- Textual responses to a cluster of four impact images (left) and four solution images (right). All images were matched on one factor by showing people with no obvious emotions.*

This builds on the growing body of research which has shown that impact and solution imagery can produce differences in efficacy outcomes, and other markers of engagement. Such research finds that images of actions and solutions related to climate change tend to increase perceived self-efficacy (e.g. Hart & Feldman, 2016a; Metag et al., 2016; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009a) and produced positive affective responses and less polarization (Chapman et al., 2016). While one study did *not* find that images of climate change and air pollution impacts decrease efficacy (Hart & Feldman, 2016a), the broad implication of previous work is that *over-reliance* on negatively framed impact imagery may lead to maladaptive responses, leaving individuals feeling overwhelmed rather than motivated to respond to the threat of climate change (Hart & Nisbet, 2011; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). This chapter again highlights the need to balance threatening framings of climate change with efficacy inducing content to avoid defensive reactions, which is consistent with analyses of Protection Motivation Theory (Floyd et al., 2000; Witte & Allen, 2000). In combination with this chapter's regression outputs, the present work suggests that solution images (showing people engaging in adaptive behaviours) should be used in combination with impact images, to increase efficacy.

7.6.3.2 Images interpreted in terms of impacts to people irrespective of content

While the different image conditions (i.e. showing people vs. people with emotion vs. no people) did not evoke a significant influence on adaptive action, threat appraisal, or negative affect, the images did influence simulation bias when people with

negative emotions were shown. Additionally, irrespective of whether the imagery depicted people or not, participants primarily interpreted the imagery through the lens of how the content of the imagery implicated themselves or other people. The most common word in all qualitative responses was the word 'people'. A fascinating finding was that even in the condition where participants did not see any imagery where people were depicted, participants still used the word 'people' the most frequently when discussing the imagery (see *Figure 7.6.3* below).

Figure 7.6:3 *- Text visualisation of participant responses to a question about what made the imagery powerful in the 'no people' condition. Participants answering this question had not viewed any imagery in the survey depicting people at the point of answering this question.*

This finding echoes research that highlights the importance of framing climate imagery in terms of emotionally resonant and authentic *human* stories (Chapman et al., 2016). Imagery where people displayed negative affect also drew out particularly emotional interpretations from respondents (see *Figure 7.6.4*). This fits with findings in health communication about the salience of imagery depicting negative outcomes for people (Byrne et al., 2019; Noar et al., 2016; Thrasher et al., 2011; Wakefield et al., 2008), Together, this adds weight to the Climate Visuals project (climatevisuals.org) recommendations; 'show real people' and 'show emotionally powerful impacts' (Corner et al., 2015).

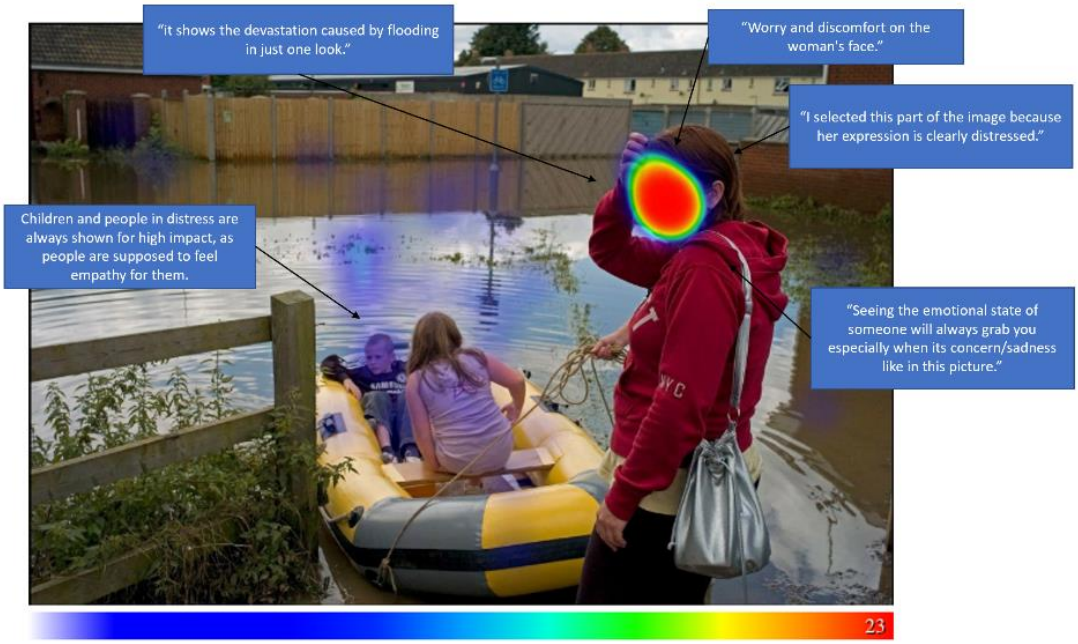


Figure 7.6:4 *- Heatmap of image depicting a woman displaying negative emotion during a flood event*

Imagery and simulation bias

To our knowledge, this is also the first work to show that simulation bias plays a direct role on adaptive action intentions in response to climate change risks. Although it exerted a small influence relative to other variables in the regression analysis, people's ability to envisage the health impacts of climate change was statistically significant and helped to explain intentions for adaptive action. This supports previous work showing that simulation plays a role in positive responses to persuasive health communications (e.g. Broemer, 2004), and other work which finds that simulation can influence decision making (Kahneman et al., 1982). Furthermore, the results showed that imagery showing *people with negative emotions* (such as the image of a family coping with flooding above) significantly influenced scores about ability to simulate climate impacts. Although these images did not influence threat appraisals or behavioural intentions directly, it suggests such images could be worthwhile employing in communications to invoke lasting mental imagery. Together, this makes the construct of simulation bias, and imagery's influence upon simulation, worthy of further attention within the field of climate change communication.

7.6.3.3 Face masks as a powerful visual symbol

Another interesting finding was that face masks appeared to be a powerful visual symbol, according to participant responses to air pollution imagery, and heatmap data. The areas which drew participants' attention the most in the '*air pollution with neutral people'* image, were clearly the face masks being worn by the individuals depicted. Qualitative responses to this image suggested the masks were a particularly powerful visual symbol, that was simple to comprehend, and clearly denoted personal susceptibility to threat at hand (see *Figure 7.6.5*).

Previous work has explained that certain images can become iconic representations of climate change. For instance, the polar bear became a particularly notable icon in visual discourses of climate change (Born, 2019). Such framings matter for a host of

reasons, including that they implicate the way that information about climate change is interpreted, shared, and acted upon (see literature review). However, while salient in the public mind, it has been argued that over-use of polar bears in communications has been unhelpful, signifying that climate change is psychologically distant, rather than a real and present threat to human livelihoods (e.g. Rowson & Corner, 2014) Similarly, research about iconic information readily employed by experts (such as the melting of the West Antarctic Ice sheet) also tend to be less engaging for lay audiences (O'Neill & Hulme, 2009)

The responses to face mask imagery in this survey alongside the clear salience of air pollution as a health concern (as discussed above) suggests that face masks have the potential to become a particularly powerful symbol in the realm of health and climate change. Unlike other symbols, they convey personal susceptibility in the here and now. Face masks should therefore be considered further as a key symbol for health-framed communications and addressed in further research alongside other potential health-focussed symbols and icons. Nevertheless, this finding is likely to have been implicated by the COVID-19 pandemic since the survey was conducted (see section below).

Figure 7.6:5 *- Heatmap image of people wearing face masks due to poor air quality*

7.6.4 Reflections on the results in light of COVID-19

This survey data was collected in March 2019, prior to the COVID-19 pandemic. This is important to note, given perceptions around the health framings of climate change, as presented in this chapter, may have substantially changed since the pandemic took hold across the globe. There are a few key points to note, that relate specifically to the findings.

First, it is very plausible that should the survey be run again, participants would perceive greater personal susceptibility to *new and emerging diseases* related to climate change, and appraise this risk as being substantially more threatening than in March 2019. When the present survey participants were asked how vulnerable they felt to infectious diseases linked to climate change (where 1= not at all

vulnerable and 7= extremely vulnerable), participants on average scored just above the midpoint (M= 4.47, SD= 1.56), with 55.6% scoring between 5-7 and just 28.9% scoring 6-to-7 on the scale. On the 27th of March 2020 (precisely a year after this chapter's survey during the height of the first peak), 61% of respondents in a national survey reported feeling *very or somewhat concerned that they will contract COVID-19* (YouGov, 2020c). Although these are not directly comparable questions, it does suggest that the salience of new and infectious disease could have shifted, given the lived experience of the pandemic.

Second, the implication that face masks could be a focal point for communication of air quality is also likely to have been disrupted. It seems probable that associations between face masks and COVID-19 is now likely to outcompete associations with air quality – potentially making this an unviable connection to draw on for climate change communication. Google trends data shows that during the pandemic in the first half of 2020, there has been very substantial increase in searches about face masks in the UK to levels not seen before (See *Figure 7.6.6* below). However, it is possible that the new relevance of face masks could work both ways. For instance, making links between face masks and new and emerging diseases related to climate change may now be *more* viable for climate communications. Nevertheless, there may be contextual and temporal differences in the viability of using face mask framings as well. Cross-national survey data showed that in June 2020 Britons were far less likely than many other nations to wear a face covering, with only 21% of British respondents doing so, versus 79 in France and 86% of Spaniards (Smith, 2020). While the use of face coverings in the UK rose to 75% by September 2020, following policy interventions, uptake has remained low in Scandinavian countries, such as Sweden (8%), Norway (16%) and Finland (21%) (YouGov, 2020a). Research should therefore consider in more detail both the viability and complexities of communicating climate change through use of imagery and messages relating to face masks.

Figure 7.6:6 *- Interest across time in 'face masks' via google web searches in the UK (Google, 2020). Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term.*

Third, perceptions around air quality appear to have shifted following the pandemic. As road travel declined by as much as 73% during lockdown (Carrington, 2020), air pollution has dropped substantially in many of the UK's major cities during the lockdown period (Defra, 2020). This appeared to generate immediate health benefits. A survey of 14,000 people with lung conditions in the UK indicated that a quarter of respondents with asthma (24.6%) and 1 in 6 people living with lung conditions (16.2%) reported an improvement in their symptoms (British Lung Foundation, 2020). Government data also indicated a decrease in the number of visits to hospital

emergency departments for asthma by half during lockdown (Public Health England, 2020).[9] Polling across six European countries (with sampling in 21 major cities where air pollution and mobility changes have been most significant), found that 64% of people surveyed did not want to go back to pre-pandemic pollution levels as they experienced good clean air; that 74% demand protection from air pollution (even if it involves reallocating public space); that 21% plan to cycle more; and 35% plan to walk more after lockdown (YouGov, 2020b). It is plausible that, having experienced this rapid, temporary change in air quality, and experiencing benefits, people's perceptions around self-efficacy *to be able to do something personally about air pollution* could have further increased since this chapter's survey. Although it was not measured as an outcome variable in the climate and health imagery survey, it would be very interesting to assess whether perceptions about the perceived effectiveness (i.e. response efficacy) of policies and behaviours aimed at limiting air pollution have now also changed, in light of the pandemic and apparent mutability of air quality. It is also possible that simulation bias could play an important role here too, given people have been able to see with their own eyes the benefits of reduced air pollution. Furthermore, it is possible that the perceived threat of air pollution will also be increased amongst the public, given there is growing evidence that pollution is increasing the number and severity of COVID-19 infections (Defra, 2020).

Overall, the key thing to note here is that while UK attitudes were assessed in a rigorous way, with a large sample, policies, attitudes and behaviours do change in response to major global events – and it is important to acknowledge this when considering this survey's findings and implications for communications into the future.

Despite this, the present survey certainly has some important general implications that could be used to inform communication interventions around COVID-19, and other future health crises. The findings highlights the utility of an extended Protection Motivation Theory model as a communications framework, and suggests that health communications should aim to: (a) increase both a sense of threat, (b) balance this by increasing a sense of self and response efficacy, (c) reduce the perceived costs of action, (d) highlight desirable social norms, and (e) use imagery of people carrying out desirable actions to further increase efficacy. The principles could be applied to a range of behavioural interventions related to COVID-19, including handwashing, social distancing measures or use of face coverings.

7.7 Conclusions

This chapter set out to assess general public responses to health-framed information and imagery about climate change in the UK. The findings highlight the importance of threat, coping and social norms for behavioural responses to climate change health threats, alongside other factors. The survey showed the salience of air pollution and its links to climate change as a key concern, compared to three other issues (flooding, heat stress, and new and emerging infectious diseases). Air pollution appeared to be salient due to universal vulnerability, its threat to the basic need to breathe and its resonance with past health problems; and participants felt greater efficacy in relation to this issue than the other health risks.

In terms of imagery, the survey highlighted that simulation bias can play a role in behavioural responses, and images showing negative outcomes for people

[9] Nevertheless, it is unclear whether this data was confounded by people's reluctance to visit hospitals during the pandemic as well.

appeared to play a role by helping individuals to form a mental picture of climate change health impacts. Images of air pollution were ranked as the most concerning and representative, although solution images were shown to increase efficacy more so than impact images.

7.7.1 Research limitations and strengths

This survey had some limitations. First, it was designed to only address four key impacts, while climate change poses a broad range of threats in the UK. It is possible that another threat, such as impacts to food security, might have been viewed as even more threatening and personally relevant than air pollution. Second, there were some limits to image selection. Due to limited timeframes, budget available, and lack of health-framed climate imagery, the survey had to make use of stock imagery, limited by scope and authenticity. According to other work on climate visuals, such imagery can be viewed negatively (Chapman et al., 2016; Corner et al., 2015). Furthermore, the manipulation of negative emotion may not have been distinct enough from other imagery showing people. Thirdly, due to the experimental design, it was not possible to assess direct effects of impact type on adaptive actions.

Nevertheless, the survey did well to address the issues and hypotheses identified at the outset of the research, and provided excellent power and generalizability, through representative national sampling. The careful selection of materials via thorough deliberation and coding allowed for credible image manipulations, given the limited selection of health-framed climate imagery available at the time of study. Furthermore, the combination of both quantitative and qualitative elements in the survey strengthened the validity of the findings, by allowing triangulation.

7.7.2 Key implications for climate change communication

The survey has several clear implications for communicators. To encourage adaptive behavioural responses to the health impacts of climate change, this analysis suggests that communications should be tailored to heighten a sense of vulnerability, severity; concern about climate change, as well as self and response efficacy; and communicate where there are positive descriptive social norms (i.e. that many people are carrying out health behaviours). One particularly effective way to do this appears to be focussing framing around air pollution impacts. Health-framed communications focussing on air pollution are likely to be particularly effective for engaging the public, as this issue was shown to elicit greater threat appraisal and was perceived to be more representative of climate change than the other health issues. The vast majority of respondents also perceived higher self-efficacy (i.e. being able to do something personally) to address air pollution - relative to flooding, heat stress and disease impacts. Images of air pollution were also ranked as being the most concerning, and representative of climate change – making them suitable for wider use. When showing imagery of impacts, it appears to be quite effective to depict *people with negative emotion*. These images were shown to significantly increase participants' ability to envisage the health impacts of climate change (at least relative to not showing any imagery at all or showing images where people have neutral emotion). Nevertheless, the findings also suggest that it is particularly important to balance threat with efficacy to encourage action, and this can be achieved by showing solution images related to climate change (e.g. people engaging in tree planting, cycling, or attending a demonstration) given these images heightened self-efficacy.

Chapter 8

Co-creating efficacy: Reflections on communication, collaboration and translating research into practice through an academic placement

Image: "Climate Outreach workshop with the Women's Institute in London", by Niall McLoughlin.

8.1 Abstract

One of the crucial, but perhaps overlooked, challenges for climate communication researchers concerns how best to translate empirical findings into genuinely engaging and impactful communications practice in the real-world. Specifically, the findings in previous chapters suggest a crucial need to find effective ways to increase peoples' sense of *efficacy* to adapt to climate impacts. In turn, co-production is often recommended as a particularly useful model for climate change communication. This approach goes beyond one-way dissemination of information and allows engagement to be tailored to different audience's needs, so may help to build efficacy. However, there has been relatively little discussion about precisely what co-production is; how it may differ from other forms of engagement (such as co-design and co-creation); and precisely how to utilize these approaches most effectively to nurture efficacy. The purpose of this chapter is to critically reflect upon the processes of embedding research insights into these types of collaborative activities, and to develop some useful insights and recommendations for communications practitioners. First, drawing on previous research, a typology of collaborative and participatory engagement is given, and critical reflections are made about the potential pros and cons of highly collaborative approaches. Then, reflections are made about personal experiences of collaborative activities during an academic placement with a leading climate change communication organisation, which focused on adaptation and efficacy. The reflexive discussion makes links with previous research, and recommendations for wider practices in climate change communication are given.

Highlights

- An audit of climate communication experts revealed support for co-production and nurturing efficacy – but also a mismatch with real world practices.
- There are different forms of collaborative engagement, which we should be careful to distinguish between within climate change communication.
- Collaborative and participatory approaches to engagement can deliver a range of two-way benefits, although previously published research suggests there may also be risks.
- My experiences working with Climate Outreach and members of the WI are a positive example of how 'co-creation' approaches can help to nurture efficacy around climate change adaption and can bring a range of benefits for the partners involved.

8.2 Introduction

This chapter is quite different to those earlier in the thesis. Now that data has been collected, analysed and reported in the previous empirical chapters, this chapter offers a space to reflect upon the process of translating research findings into real-world practice, and the benefits and potential challenges of doing so. Specifically, this chapter reflects upon work carried out during an academic placement at the climate change communications charity, Climate Outreach.

The emphasis of discussion in this chapter concerns the potential challenges and opportunities of collaborative engagement, such as co-production. While the definition of co-production is considered later in the chapter, broadly speaking, it can be characterized as a form of (climate change) engagement that proactively involves partners and end-users in the design of activities and outputs (Howarth, 2019). In terms of methodology, the activities in this chapter are collectively referred to as a form of 'participatory action research' (see methods section).

By way of introduction, a brief overview of the placement is given, and context for the chapter draws upon an audit of climate change communication experts, which formed part of the placement work. The chapter then considers the theory of different types of collaborative activities, and potential pros and cons of collaborative engagement, drawing on previous literature. Finally, the chapter reflects upon my own practical experiences of embedding efficacy into activities during my placement at Climate Outreach.

***Please note**: All reflections in this chapter are, of course, my own and may not represent the views of the organisations mentioned throughout. Please also note that given the emphasis on reflexivity, in this chapter, unlike the others, I will use personal and collective pronouns ("I", "my", "we", and so on).*

8.1.1 Brief overview of the placement

Between October 2018 and March 2019, I participated in an academic placement with Climate Outreach (www.climateoutreach.org), based in Oxford. The placement was funded by the ESRC SWDTP and was set up to be mutually beneficial – with the aims created together. I joined the charity as a full-time research team member, working on a range of ongoing projects that were taking place during my placement period. The placement was designed to give me a range of experiences relating to climate communication, and at least one chapter for my thesis.[1]

The placement involved a broad range of exciting climate communication activities. During my placement I directly contributed to three reports related to climate engagement, helped design and facilitate two workshops to train members of the public in communicating impacts and adaptation (discussed later); ran a nationally representative survey (see *Chapter 7*); and even helped co-create a short film about best practices in visual communication of climate change. The collaborative activities can be broadly thought of in two ways:

1. Co-created projects with the charity and partners - In this case the 'end-users ' were either the charity, or clients that the charity were working with. This type of work encompassed the majority of the placement activities.

[1] Note that I actually came away with two chapters based on placement work; this one and *Chapter 7.*

2. Co-created workshops with members of the public. In this case the 'end-users ' were members of the public – specifically Womens' Institute (WI) Climate Ambassadors.

The range of activities are summarized and reflected upon later in the chapter, nevertheless, the findings of the first project I worked on are particularly worth noting by way of introduction. This was a collaboration between Climate Outreach and The Climate Communication Project (www.theclimatecommsproject.org) that aimed to 'audit' the current perceptions of UK based climate change communications practitioners (including scientists, social scientists, members of the NGO/charity sector and media professionals/journalists). I led on the qualitative analysis and report writing, bringing together the key findings from an audit survey (N=178) and an expert elicitation workshop (N=15). The research explored some of the key areas of consensus and disagreement about how best to engage the UK public on climate change (see: McLoughlin et al., 2018).

The findings of this expert audit research highlighted very clearly that expert practitioners believe that co-production and dialogue are very important approaches to climate engagement. There was widespread support for participatory methods and dialogue – 84% said it was very/extremely important to provide people with an opportunity to discuss climate change (Ibid: p.12). At the same time, practitioners extolled the virtues of nurturing a sense of efficacy and empowerment amongst those being engaged with – helping the audience to realize what key actions they can carry out themselves and how to make a difference. This finding strongly validates many of the findings in the previous chapters of this thesis. However, while practitioners noted that *"two-way discussions are more fruitful [for] engagement than a one-way lecture"* (Ibid: p.11), one-way public presentations and talks were still appeared to be the norm for most communicators. When asked to consider a recent memorable activity, 52% had carried out a public talk or presentation, while only 26% included a discussion element. Practitioners also cited a lack of dialogue and participation as a key challenge for engagement, and some highlighted that they had troubles meeting audiences' needs, tailoring engagement activities and ensuring positive interaction. There were also disagreements about whether communications should even try to foster behavioural change.

Together, this suggests some important mismatches. While co-production is clearly valued by practitioners, it is not necessarily being carried out effectively in practice. Also, while nurturing efficacy is seen as an important goal, there may be some confusion amongst practitioners about how best to foster this. Given the growing interest in co-production activities relating to climate change (see literature review), it is now of critical importance to evaluate how to optimize these types of activities. In turn, it makes sense to critically reflect upon the rich set of experiences I had relating to collaboration and participatory methods whilst a placement researcher at Climate Outreach, given they could be of value here.

8.1.2 Research questions

Based on my experiences of collaboration, co-creation and evidence-based climate engagement with the partners, I will aim to draw up some key insights and recommendations relating to the following research questions. While these questions were not pre-defined, they will be used to organize the reflections:

RQ1: What distinguishes co-production from other forms of collaborative or participatory engagement, and how can these be applied to climate engagement?

RQ2: What are the potential pros and cons of highly collaborative work?

RQ3: Following my own experiences, what useful insights can I share about nurturing efficacy through co-created research and engagement activities with Climate Outreach?

Reflecting on these questions, it is hoped, will help to unravel the challenges in collaborative climate change communications, and provide some solutions and recommendations for doing so. Before this discussion though, it is worth briefly formalising the methods being applied here.

8.3 Methods

8.3.1 Viewing an academic placement as 'participatory action research'

Participatory action research (PAR) is a highly applied, immersive and typically qualitative research method, which combines research, education and action together (Krasny & Bonney, 2005; Reason & Bradbury, 2001). In PAR, researchers are involved in a process of making change in the real world, typically in a collaborative context, and developing insights based on their experiences (Reason & Bradbury, 2001). While other forms of qualitative research may involve observing, analysing and reporting on meaning, theory, concepts and ideas at play within a social context; an action researcher is actively involved in influencing, affecting and reshaping phenomena of interest to their research area (Reason & Bradbury, 2001). In this sense, phenomena are considered to be malleable, and the researcher and theory exist in a dynamic relationship – with each shaping one another over time (Eikeland, 2006). By engaging in activities 'on the ground' themselves, the action researcher typically generates new knowledge by reflecting upon, reviewing and evaluating the process of being engaged in client-focused, change-focused and problem-solving activities.

PAR has been used in varied environmental research projects previously. For instance, one project used PAR to develop citizen science for environmental education (Krasny & Bonney, 2005), and in another, PAR was conducted for the creation of murals to foster community conservation of sea turtles; an activity which was shown to influence local pro-environmental attitudes (Schneller & Irizarry, 2014). Similarly to this thesis, another recent PhD project at the University of Bath, which also addressed environmental behaviour, used action research to apply results once empirical findings had been finalised (Thomas, 2014). This work translated psychology insights about transport mode choices into the development of new walking networks in the city.

An action research method was highly suited to the aims of this chapter, given that I was keen to apply the results from this thesis in the real world, and play a role as an active agent in the engagement activities during my placement, rather than just being a passive observer. I was also interested in developing some insights into activities like co-production, which are increasingly recommended with climate engagement (Howarth & Morse-Jones, 2019) – so action research provided a good framework to balance these aims. In addition PAR is well placed to explore interactions between academic and non-expert knowledges (Eikeland, 2006). Also, given that several of the projects at Climate Outreach were planned to take place anyway (irrespective of my involvement) an action research approach was flexible enough to allow me to engage with diverse projects and soak up experiences – without having to pre-plan,

or structure research questions and agendas at every step, which could have been highly disruptive in this context.

Action research is distinct from concepts like co-production and co-creation in the sense that it is a broader research methodology, rather than a very specific form of collaboration or engagement (see later in the chapter for specific definitions of collaborative engagement approaches). Action research describes the overarching process of generating insights as an active agent in the process of making changes happen. However, this could take many shapes and forms (e.g. public engagement, citizen science, co-production with stakeholders, and so on). Nevertheless, there are strong overlaps between PAR and collaborative activities. By formalizing collaboration as PAR, the research element of the collaboration is given a greater weight, and the formal generation of knowledge becomes an objective in and of itself.

This chapter seeks to be *reflexive* – meaning there is a focus on the role of the researcher (i.e. myself) within the research process, and questioning taken for granted assumptions (Hammond & Wellington, 2012). It thus contrasts with many of the earlier more positivist chapters, which give an illusion that the research is free of the values of the research (Hammond & Wellington, 2012). Nevertheless, there is also an element of *reflection* (e.g. what insights and recommendations might be drawn from evidence and my own experiences).

A limitation of reflexive action research is that, due to its qualitative, subjective, and almost ethnographic nature, its findings can never be totally conclusive or generalizable. There are no ways to test hypotheses, or check for statistical significance, unless a hybrid approach is taken which combines quantitative elements into the action research agenda. There are also some important tensions inherent in PAR. These concern the balance between the extent of the research versus the action elements, and whether the research and agenda should be set by the researcher or participants (Reason & Bradbury, 2001). This latter point is something discussed later in the chapter, as a tension shared with co-creation.

8.3.2 Research diary

As is common in action research, a research diary was kept throughout the placement (Reason & Bradbury, 2001). This was used to log key experiences, ideas, notes, thoughts, and other relevant information during the academic placement. Reflections were then arranged and consolidated into broad themes and sub-themes, and then organised into written sections. The process of reflection and refinement of these themes continued after the placement, and during the writing up stage, with feedback from the supervisory team.

8.3.3 Ethics

As with the previous chapter, the ethics related to this work were overseen by Climate Outreach, following discussions with the Doctoral College and the Ethics Committee at University of Bath (see appendix). Climate Outreach also discussed the nature of reflective work with the WI ahead of the workshops (which forms a key element later in this chapter), on my behalf, to ensure participants were comfortable with me writing up reflections in this thesis. As noted above, all reflections in this chapter are my own, and do not necessarily represent the views of any of the organisations or partners mentioned in this chapter.

8.4 Reflexive discussion

8.1.3 Discussion point 1: Understanding different approaches to participation and collaboration in relation to climate engagement

Participatory and collaborative engagement comes in many different shapes and sizes – and it's important to reflect upon this when planning climate engagement. As noted in the literature review, co-production is increasingly advocated for climate engagement (Howarth & Morse-Jones, 2019), and is being applied in contexts like flood management and catchment partnerships (e.g. Barr & Woodley, 2014; WCCP, 2020), as well as community adaptation to sea level rise in places like Fairnebourne in Wales (CCC, 2018). Despite this, confusion remains about what terms like 'co-production' mean, how they can be disentangled from other related concepts, and when they should be used, and why (Oliver et al., 2019; thinklocalactpersonal.org.uk, 2019).

The discourses around co-production are still in their infancy, and so providing a clear definition of *what is* and *what is not* co-production was an immediate challenge (Oliver et al., 2019). There are various related terms within collaborative and participatory engagement, each with different definitions and implications; and confusingly, these are often used interchangeably. Furthermore, while the need for greater dialogue and co-production was recommended by climate change communications practitioners, such recommendations perhaps do not also make clear the distinctions between more 'conversational' ways to engage members of the public at an event, and 'co-production'. Some clarity thus seems to be needed.

It might be suggested that co-production is characterised by an emphasis on end-user participation. As noted above, co-production involves making an effort to include end-users into a decision making process, helping to democratise decision making (Howarth, 2019). Such 'end-users' can be from any number of different groups, including members of the public, specific demographic groups, the climate science community, policy makers, academics, or business executives (and so on). However, the inclusion of end-users is not alone enough to distinguish co-production from other approaches, given other forms of participation involve diverse public(s), partners, and collaborators. Instead, the *dynamics* of participation seems a more useful way to make some initial distinctions.

The co-production ladder (*Figure 8.4.1*) provides a simple, but useful visualization of the different types of participatory engagement (thinklocalactpersonal.org.uk, 2019). This ladder is organized by the levels, or intensity, of participation of citizens and end-users. It suggests there are three broad levels – *"doing to"* (where end-users are passive recipients), *"doing for"* (engaging and informing) and *"doing with"* (i.e. a reciprocal relationship).In terms of specific activities, at the very bottom of the ladder is *coercion* – a manipulative form of persuasion with zero participation from end-users; and above this is, *educating*, which is not manipulative, but end-users are similarly treated as *"passive"*. These approaches are proposed to create change in recipients, primarily through one-way communication. This is controversial, as it could be argued that education is intrinsically a dyadic process – nevertheless, the definition appears understandable when applied to one-to-many approaches that seek to educate, such as lectures, or presentations, which typically have limited interaction with audiences. Above this *informing*, *consultation* and *engagement* have higher levels of two-way involvement and interaction; and at the top are *co-design* and *co-production* – which represent much more involved, dyadic participation.

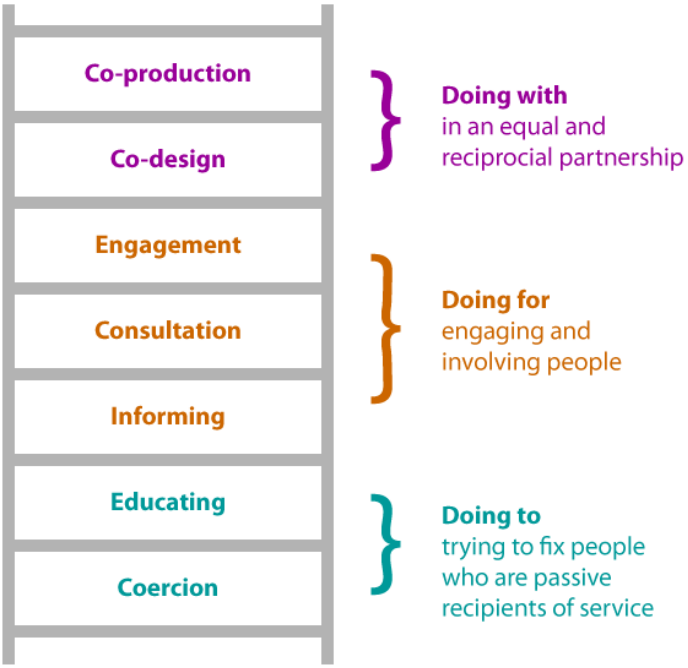


Figure 8.4:1 *- 'The ladder of co-production' (source: thinklocalactpersonal.org, n.d.: npn)*

While this ladder is usefully organized, arguably it doesn't go far enough to distinguish terms at the top, and suggests co-production is the highest possible form of participation. There are several other models of reciprocal participatory engagement that are frequently used (again interchangeably) in the literature, by researchers and by practitioners. These include co-design and co-creation. This, I think, has led to some confusion about what co-production is; and when it has or has not actually been carried out. Relating this back to the expert audit discussed earlier, it is possible that such confusion may even have created some hesitation from researchers and practitioners to carry out participatory methods (given that a lack of distinction makes all forms of participatory engagement sound equally involved, and effortful). In turn, *Table 8.4.1* (below) provides a breakdown of how I see the distinctions between the key terms, based on existing literature.

The table highlights that there are important differences between 'co-design', 'co-production', 'co-creation' and 'co-creation with continued co-learning and co-evaluation'. These terms can be distinguished by having different dynamics and levels of participation intensity. All the models of participation in the table involve:

(a) two-way learning (to some extent).

However, they can be distinguished according to whether the activity also involves:

(b) conceiving the aims of the activity together (i.e. the agenda is created together)
(c) substantial problem solving together during the research process
(d) delivery together (i.e. production or implementation of outputs)
(e) continued evaluation and co-learning relationship.

These distinctions are not drawn to suggest that highly participatory approaches are inherently more valuable than less participatory approaches (as discussed in the next section) – but merely to provide some clarification and distinctions between terms.

Table 8.4:1 *- Typology of collaborative and participatory methods, extending the top of the co-production ladder (see section above). The top example in this typology illustrates how end-users may be incorporated into ongoing evaluation, iteration and refinement. Please note that continued co-evaluation and co-learning could be appended to the other methods below as well, though this is not essential.*

Level of end-user participation	Term	Definition	Two-way learning	Problem solving together	Delivery together	Aims conceived together	Continued evaluation & co-learning
Highest	Co-Creation + continued co-learning and co-evaluation	The process of actively involving end-users throughout the various stages of a design and production process, and also ensuring there is a continued long-term relationship of feedback and co-learning. **Extends co-creation (see below) through a longer-term relationship with evaluation.** *(Sources: Brandsen et al., 2018; McDougall, 2012; Voorberg et al., 2014)*	✓	✓	✓	✓	✓
Very High	Co-creation	The process of actively involving end-users throughout **an entire process of active participation, including ideas generation, solving problems and implementing solutions together.** This form of collaboration **arguably achieves the most equal power dynamics between service provider and end-user.** *(Sources: Brandsen et al., 2018; McDougall, 2012; Voorberg et al., 2014)*	✓	✓	✓	✓	✗
High	Co-production	A form of collaborative engagement incorporating diverse actors into decision making and implementation processes. **Emphasis is placed on producing or making something happen together, shared development and implementation**. It is characterized by a focus on end-users, non-academic actors, inclusivity, collaboration, self-reflection and embracing challenges and 'uncomfortable moments. *(Sources: Howarth & Morse-Jones, 2019; McDougall, 2012; Oliver et al., 2019)*	✓	✓	✓	✗	✗

Medium	Co-design	An active process of collaborative engagement where **emphasis is placed on problem solving and designing potential solutions and aims together, but not implementation.** Typically, non-academic actors, stakeholders and users are incorporated into **discussion and dialogue centring on the 'what', 'how' and 'why' of resolving an issue, without subsequently being actively involved in the 'doing'** of decision making, production or implementation of those plans. *(Sources: McDougall, 2012; NCAG, 2020)*	✓	✓	✗	✗	✗
Low-to-medium	Engagement	Participatory public engagement seeks to involve diverse actors, stakeholders and/or end-users **into a two-way dialogue around a specific issue or problem, where the emphasis is on knowledge transfer.** It is distinguishable from co-design and co-creation in that those involved are generally not engaged with to design or produce something together. Despite this, useful knowledge may be generated through the encounter that may later be used to develop solutions within a specific issue context. It is also distinguishable from concepts such as co-production in that participation may be more passive. *(Sources: Corner & Clarke, 2017; NCAG, 2020)*	✓	✗	✗	✗	✗

According to this typology, ‘public engagement’ has the lowest relative intensity of participation, while ‘co-creation with co-evaluation’ has the highest. This is somewhat controversial, as some may argue that the definition of ‘public engagement’ is more flexible, or that it covers all these terms. This perspective is understandable, though I think there is a marked difference between engaging with the public or partners *after* research, a product or service, is complete (as is typical in public engagement), versus doing something genuinely collaborative during a live research, or a production process. Others may suggest that ‘true’ public engagement only applies to activities that involve a combination of (a) two-way learning, (b) conceiving aims together and (c) problem solving during the research process (i.e. akin to something higher up the ladder like co-production). However, I think this perspective is somewhat unhelpful in that it downplays the value of two-way learning in the absence of the other elements. It also puts pressure on researchers and practitioners to invest greater time and energy to achieve very high intensity of participation, rather than select the most appropriate approach for their specific aims and circumstances.

Finally, I would also add that the terms ‘participation’ and ‘communication’ span all of the concepts in this table – while the terms ‘collaboration’ and ‘co-learning’ apply to anything higher up the ladder than public engagement (i.e. terms involving the prefix ‘co’). As noted in the thesis introduction, communication can manifest as either a one-way or a two-way process (Klöckner, 2015), and in this sense, the dynamics of communication will simply differ according to the specific approach adopted.

So, what does this mean for climate communication researchers and practitioners? First, it suggests that we should be careful to use terms like ‘co-production’ to describe specific dynamics of participation, and not just any form of engagement involving dialogue. Second, if some form of participation is envisaged for an activity, climate communicators can use the decision tree below (see *Figure 8.4.2*), which applies the table’s distinctions to help reflect on some important questions, and guide decision making.

Beyond this, if an activity does *not* involve developing an agenda, aims and objectives together with partners (i.e. co-creation); practitioners should also consider specifically what sorts of problems need to be addressed with the help of partners, and which types of partners and end-users should be involved (i.e. who are the ‘end-users’?). Practitioners should also consider whether highly collaborative approaches like co-production and co-creation are genuinely achievable, desirable or necessary – before committing to such approaches. Such decisions should also involve consideration of the range of potential pros and cons of highly collaborative approaches, like co-production, which will be the focus of the next section.

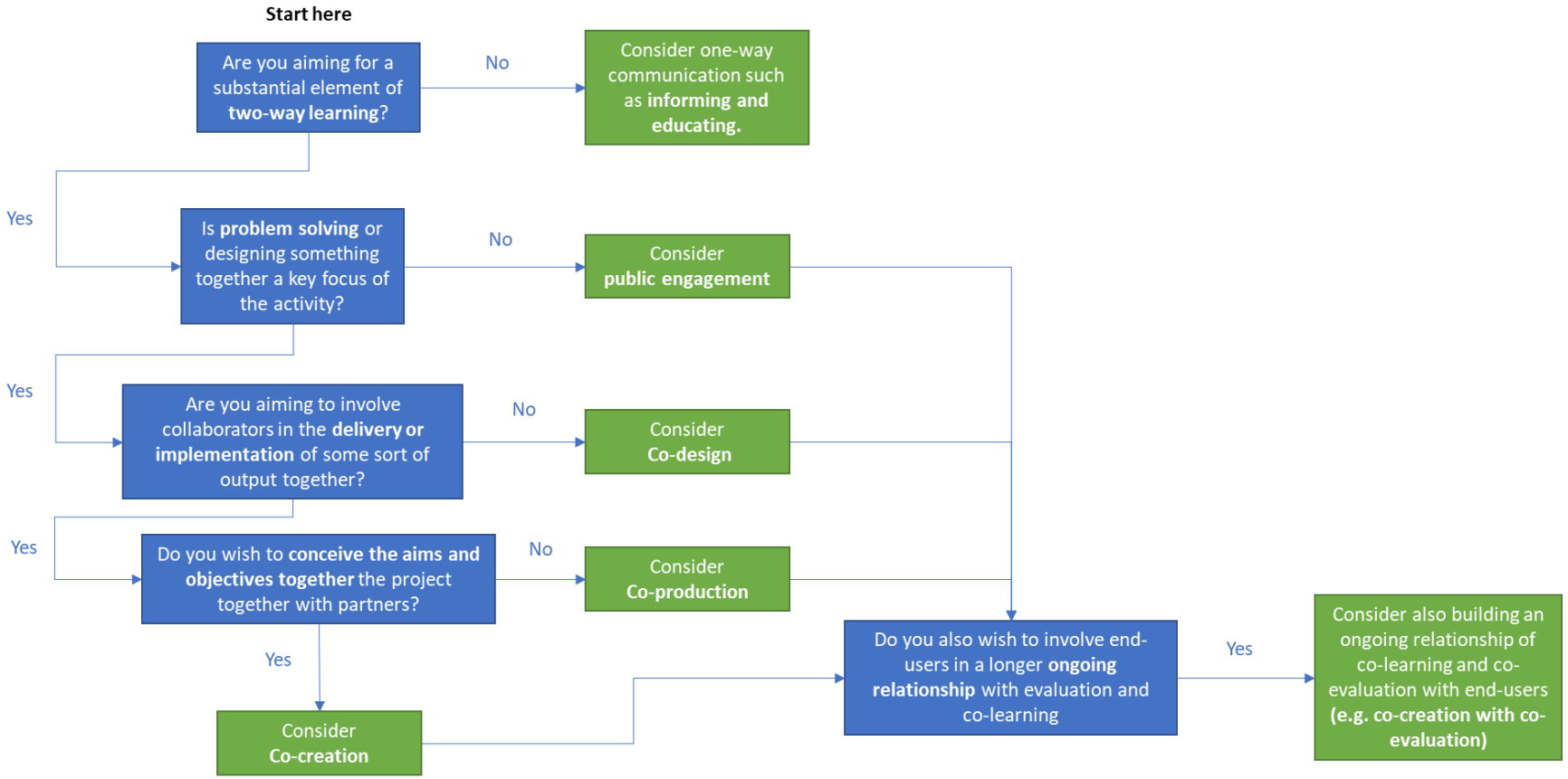


Figure 8.4:2 *- A decision tree to help guide the selection of one-way, participatory and collaborative engagement*

8.1.4 Discussion point 2: The potential pros and cons of collaborative climate engagement

Previous research suggests that are many possible benefits to carrying out collaborative engagement practices, like co-design, co-production and co-creation, but also some risks too. It is worth reflecting on these when considering whether to pursue such approaches, as it may help to decide if less collaborative techniques, like public engagement, or more passive forms of communication, like informing and educating are in fact more appropriate.

8.1.4.1 Two-way benefits of collaborative engagement

At the core of collaborative methodologies are a dynamic that brings together service providers with service users. In a research context, this holds the key benefit of **bridging academic and experiential knowledges**. The coming together of expert and public perspectives, insights and experiences has been referred to as 'phronesis' by some scholars (Eikeland, 2006), drawing on the ancient Greek term meaning practical wisdom derived from experience. Phronesis can be important in climate engagement, in myriad ways - such as helping to identify issues, solutions, highlight past successes, and guide decision making. For instance, if policy makers designing solutions to flooding include end-users, this can help to identify specific barriers, issues, and paths forward (as carried out in citizens' assemblies in Poland recently - see Gazivoda, 2017). For such reasons, local knowledges are viewed as being integral to adaptation efforts (IPCC, 2014).

Barr & Woodley (2019) go further, to argue that collaborative learning and decision making is vital for building community resilience to climate hazards. They suggest that social learning approaches are needed to go beyond what they describe as highly individualised behaviour change interventions (especially 'nudge' approaches), which typify an increasingly libertarian-paternalistic model of policy delivery in the UK. As noted in the literature review, nudge approaches to behaviour change certainly are limited in that they are passive, disempowering, and often only deliver piecemeal changes. Thus, they are likely to be insufficient for responding to climate change. (These points were also made in one of our placement outputs; see: McLoughlin et al., 2019).

However, not all behaviour change is passive, or nudge driven; and thus, psychologically informed behaviour change approaches and collaborative engagement don't need to be mutually exclusive. For instance, I have previously argued that phronesis can be of benefit to the design of climate change communications seeking to facilitate behaviour change, in that it helps to identify specific needs, values, and framings of languages and visuals that are resonant for specific audiences (McLoughlin, 2015). Broadly speaking, such approaches inform the approach taken to tailoring climate communications to specific audiences (e.g. COIN, 2015; Marshall et al., 2016). Thus, phronesis is essentially one of the key functions of organisations like Climate Outreach, which are positioned to bridge the gap between academic research and practice, to help drive societal transformations to better cope with climate change.[2]

[2] See: https://climateoutreach.org/purpose/

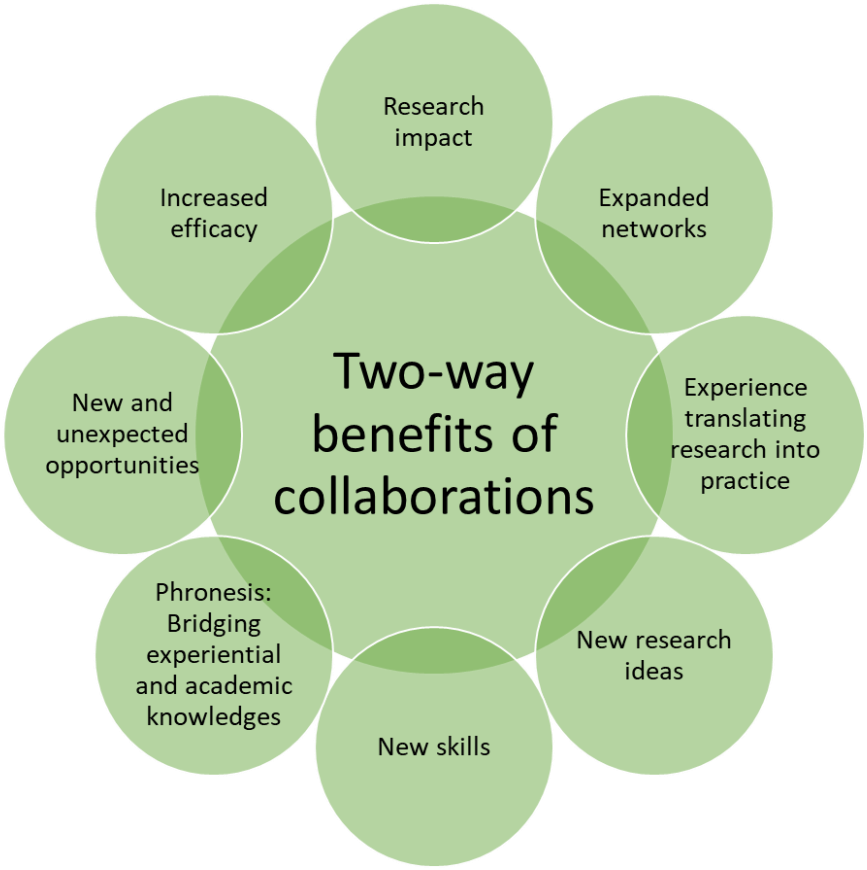


Figure 8.4:3 *- Potential two-way benefits of collaborative and participatory methods - adapted and expanded from Vanleene et al. (2015)*

The benefits that flow from phronetic relationships can be dyadic, leading to positive outcomes for the various partners involved in a collaboration (see *Figure 8.4.3*). Vanleene et al., (2015) has highlighted multiple possible benefits of co-production, including **better services** (e.g. cost-effectiveness, quality, satisfaction, performance), **better relationships** (e.g. learning, trust, being considerate for clients/citizens' needs), and **better democratic quality** (e.g. empowerment, fairness and equity. In this sense, collaboration goes beyond 'governing from a distance', and shifts to a new epistemology of knowledge production (Barr & Woodley, 2019).

Collaborative learning approaches may also foster the development of **new skills** for partners involved, as they are challenged to work in new and unfamiliar ways. Related to this, collaborative work could **increase efficacy**, as well as partners' sense of confidence and motivation to carry out relevant activities. For instance, participation in flood action groups, social learning opportunities, and social/technical skills are found to be associated with self-efficacy related to flood protective behaviour (Dittrich et al., 2016; Seebauer & Babcicky, 2020). Fittingly, other researchers have framed the co-production of flood-relevant knowledge as opportunities for *"developing collective competencies"* (Whatmore et al., 2008: 7). This makes sense, given efficacy is thought to be increased via social learning, mastery experiences, and social persuasion (Bandura, 1994) – opportunities which can be fruitful within collaborative activities. Confidence building is often viewed as an inherent part of co-production (e.g. (Involve, 2018a), and it has thus been argued

that *"enabling community knowledge brokering"* allows for collective confidence building and opportunities for empowerment that go beyond current approaches, such as behavioural nudges (Barr & Woodley, 2019: 117).

Through collaborations, researchers and end-users can also gain **experience translating research into practice** (as discussed later in this chapter). As I experienced through my placement, translating research into collaborative activities offers opportunities for increased **research impact**; as projects and communications can be more easily tailored around specific users' needs, problems and interests; and the research outcomes can be more easily disseminated to user groups involved (see next section).

When bringing together diverse partners, collaborative methods can facilitate **expanded networks**. During my placement, I was able to network with many different agents of change from diverse backgrounds, all working on climate issues. Ironically, I networked with more academics than I had during other times in my PhD. Through such encounters, collaborations can help generate **new research ideas**. Furthermore, **new and unexpected opportunities** may emerge as a result of discussions, identification of new issues, potential solutions and so on. A good example of this is the health imagery survey, presented in the previous chapter, which was not pre-planned ahead of my placement, but arose circumstantially.

Some of the benefits may be more likely to emerge with more intensive, long term approaches, like co-creation (e.g. new research ideas may be more likely when co-creating aims and objectives together). Nevertheless, each point here may apply to any participatory or collaborative methods.

8.1.4.2 Potential risks of collaborative engagement

While collaborations and partnerships can bring benefits, they may also have some potential risks (see *Figure 8.4.4)*. Again, these are worth reflecting on. Scholars have highlighted that collaborative engagement, such as co-production, can have **practical costs** (e.g. admin burden, time, and financial costs), **personal costs** (e.g. interpersonal conflict) and costs to stakeholders (e.g. sacrificing time) (Oliver et al., 2019). Collaboration add additional relationship dynamics into problem solving, and therefore also **add additional complexities**, such as increasing the number of stakeholder perspectives that must be considered, and increased challenges of finding compromises.

Figure 8.4:4 *- Potential risks of collaboration with members of the public and end-users, adapted and expanded from Vanleene et al., (2015) and Oliver et al., (2019).*

Participatory approaches may thus be problematized by the need to negotiate **stakeholder biases** (Vanleene et al., 2015). This is especially relevant to engagement around climate change issues, where there may be **conflicting goals** between different partners. For instance, the issue of flooding is fraught with tensions, or 'knowledge controversies', surrounding both the causes of floods, and best way to reduce flood risk (Whatmore et al., 2008). Following the implications of earlier chapters in this thesis, it's possible that aspects of co-learning activities **may threaten the psychological needs or strongly held beliefs** of individuals involved; even despite the possibility for increased participation and trust. For instance, workshops about the benefits of natural flood management practices may be perceived to be threatening in a strongly pro-dredging community – irrespective of their collaborative nature. Tensions may also result from **status quo biases,** whereby some partners may be less likely to advocate for rapid, transformational or adaptive changes required to build community resilience. This is important, as system justifications have been noted as key barriers toward greater climate action (Gifford, 2011). Other biases may also emerge too – such as **availability bias** – where individuals may focus overwhelmingly on what is salient at the moment in time, rather than being relevant to the activity or decision at hand (Kahneman et al., 1982). A mismatch in perceptions between partners might be a key sticking point if the aim of collaboration is to find ways to promote *rapid* social transitions or focus on very specific issues outside of the availability bias.

Due to such issues, collaborative approaches may result in **stakeholder dissatisfaction**, and may also risk a **lack of impact** (Vanleene et al., 2015). Thus, although controversial, it is worth considering that collaborative approaches, in some circumstances, may risk producing **less optimal solutions and outcomes**. Past research has highlighted that idea generation activities involving many participants can lead to fewer and less useful ideas, compared to individuals carrying out the same task alone (Stroebe & Diehl, 1994). In turn, perhaps it is possible that an *"illusion of group effectivity"* (Ibid., p. 271) has led to an overestimation of the benefits of collaborative engagement. This is probably a moot point, given climate change fundamentally requires collaboration, and change at many levels of society. Nonetheless, perhaps within collaborative learning exercises, individuals should be given personal space for idea generation; or, collaborations should be combined with self-led problem-solving activities, outside of group contexts. At minimum, these dynamics are worth reflecting on, especially given that original conceptions of co-production suggest that activities should be simultaneously *individual* and *collective* (Involve, 2018b).

8.1.4.3 Navigating possible controversies in collaborative engagement

Together, the issues above raise important, and challenging questions about how to conduct collaborations effectively. How should practitioners navigate any tensions, biases or conflicts that may arise? Should practitioners be selective with participants? Should certain decisions be made about the agenda and scope of activities in advance?

One perspective suggests climate communications practitioners should take a cautious approach when selecting which 'end-users' to involve. In this sense, practitioners may make efforts to collaborate with people and groups who are already very aligned in their values and aims. For instance, a growing number of scholars and practitioners have expressed caution about spending time trying to convince climate deniers, when more may be achieved through galvanising those who are already concerned about climate change (e.g. Hedahl & Rieder, 2017). This would make for a crude approach if applied in collaborative engagement, given it would contradict efforts to *democratise decision making*. Furthermore, there is evidence that certain narratives and framings can help to engage groups that have historically been more sceptical about climate change, including the centre-right and certain faith groups (Bain et al., 2012; COIN, 2015; Corner et al., 2016; Marshall et al., 2016; McLoughlin, 2015). In turn, perhaps a more rounded approach here is to aim for a group that is representative of the broader population. For instance, the recent Climate Assemblies ensured that participants were representative of current levels of public concern around climate change. Given a small minority (5.1%) of the UK population are not at all concerned about climate change, such attitudes were not overrepresented in the activities, while the democratic integrity of the process was maintained (Climate Assembly UK, 2020). Of course, a representative approach may not always be possible or circumstantially desirable (e.g. when debating local, rather than national priorities; or when collaborating with specific demographics).

Another approach involves focussing collaborative activities on the *'means'* (i.e. how to achieve targets) rather than the *'ends'* (i.e. what the targets are) of climate issues. If decision making is a key part of the activity, practitioners may decide the desired 'end' goals in advance (i.e. top-level goals, outcomes, aims, or how radical societal changes need to be). Then, co-learning activities may be focused on the trade-offs and challenges of achieving that pre-defined end. This would be more akin to a co-

design approach, where aims are not created together, *a priori*. For instance, the discussions of the Climate Assemblies focused on *how* to transition towards a low carbon economy. Thus, the 'means' were the focus, rather than the 'ends' which were taken as given (the UK government had announced a Net-Zero by 2050 target prior to the assemblies). While this approach was appropriate for the Climate Assemblies, in other contexts, it could be controversial, especially if end-users expect to be included in agenda setting. For instance, it may introduce tensions and power imbalances about who decides upon agendas, goals and priorities. If practitioners believe it is not appropriate to be pre-deterministic with agendas, then their best option is to use a co-creation approach. However, even within co-creation activities *the personal is political* (Cahill, 2007), as any agenda setting involves some degree of influence from different partners involved, and this can obfuscate efforts to be unbiassed.

A third perspective suggests that rather than problems to be avoided or resolved, *"knowledge controversies"* (i.e. disagreements, tensions, conflicts) are beneficial opportunities within the co-learning process (Whatmore et al., 2008). This perspective stems from a philosophy of science where emphasis is placed on the practice of knowledge production – in other words, science 'in-the-making' rather science that is 'ready-made' (Ibid.). Interest is thus placed on the ways scientific claims are produced and subsumed into policy, rather than seeking to find consensus. This approach has been applied through 'competency groups' in Ryedale, North Yorkshire, which involved a broad range of activities (e.g. bringing objects to prompt discussion, video elicited discussion, computer modelling tasks, and reading groups). These activities delivered a range of outputs, including recommendations for flood risk management in the area (Whatmore et al., 2008). However, it is difficult to disentangle whether the specific principle of 'working with controversy' led to collaboration that was fundamentally distinct from other forms of in-depth co-creation. Furthermore, this approach does not provide practical advice about how to navigate substantial tensions that may derail progress toward shared goals.

In turn, if practitioners decide *not* to be selective with partners, or aim to be representative of the wider public, they may benefit from planning out how to negotiate biases carefully, should they arise. First, practitioners could avoid posing a threat to pre-existing beliefs – at minimum acknowledging tensions, but ideally also de-escalating them. The results in *Chapter 6* suggest that practitioners should use non-threatening message styles, which emphasise freedom to choose (even if they disagree with partners). This could also entail addressing partners' underlying psychological needs for efficacious solutions. Partners may find it constructive if time is dedicated to identifying which solutions are most likely to address those needs, without dwelling on negating maladaptive solutions, or challenging beliefs etc.

Second, practitioners could ensure that trusted in-group members have a key role in activities (as discussed more in the next section).

Third, if there is a need to challenge misinformation and status quo biases, then certain framing approaches could be adopted. For instance, past research suggests that framing climate action as part of, rather than in contradiction to, current economic and social systems, to help negotiate status quo orientation (Feygina et al., 2010). If tackling misinformation head on, practitioners may also try to ensure that they do not simply retract or discount something, but also provide an *alternative* explanation

(Lewandowsky et al., 2012). Rather than just saying *"Solution X is unlikely to help",* more constructively, one might say *"Solution X is unlikely to help, AND solution Y is more effective"*. More work is needed to address the best ways to navigate such tensions within collaborative engagement, but these suggestions may help to minimise some issues.

8.1.5 Discussion point 3: My experiences of nurturing efficacy through co-created research activities with Climate Outreach

So far, my reflections have been largely theoretical, informed by past literature. In this part of the chapter, I now turn to reflecting on my personal experiences of collaborative research and participatory activities, during an academic placement with Climate Outreach. Specifically, I focus on the process of translating and embedding the implications of this thesis work, into the climate engagement activities. Based on my experiences, I seek to develop some recommendations for practitioners aiming to increase people's efficacy, through collaborations.

The placement provided a range of projects and opportunities, through which I could share and embed specific insights from my PhD work. A more detailed overview of the activities is given in *Table 8.4.2*. This table outlines the placement activities, my contribution, as well as the specific form of participatory engagement for each activity. The range of activities and experiences was diverse and included both internal and external partners. Thus, the experiences allow for a great deal of reflection on the nature of these types of co-learning activities. These specific projects did not just represent one form of collaborative activity, according to the typology detailed earlier. Nevertheless, the placement can overall be thought of as 'co-creation with continued co-learning and co-evaluation', given that the placement aims and objectives were mutually defined, and upon completion, I have been able to continue the collaboration as an *Associate* of the charity.

Table 8.4:2 *- Details of placement activities and format of participatory engagement. Activities are presented in chronological order. The placement overall can be considered as an example of "co-creation with longer term co-learning and evaluation", and specific activities can be thought of as discrete forms of collaborative or participatory engagement.*

Project Title + Links	Output	Type	Brief Description	Personal Contributions
1. Climate Communication in Practice – How are we engaging the UK public? Report: https://climateoutreach.org/resources/climate-communications-in-practice-engaging-uk-public/ Blog: https://theclimatecommsproject.org/climate-communication-in-practice/	Report + Blog	Co-design, Public engagement	This was a collaboration between *Climate Outreach* and *The Climate Communication Project*. It aimed to 'audit' the current perceptions of UK-based climate change communications practitioners (including scientists, social scientists, members of the NGO/Charity sector and media professionals/journalists). By bringing together the key findings from an audit survey (N=178) and an expert elicitation workshop (N=15) the report explored some of the key areas of consensus and disagreement about how best to engage the UK public on climate change.	• Lead report writer • Lead on analysis of qualitative and quantitative data • Liaised with a graphic design company to produce a set of engaging infographics • Oversaw edits and feedback
2. Mainstreaming low carbon behaviours https://climateoutreach.org/resources/mainstreaming-low-carbon-lifestyles/	Report + Webinar	Co-production	A report drawing on key findings from Cardiff University's Low Carbon Lifestyles & Behavioural Spillover (CASPI) programme. The CASPI findings, collected over 5 years in 7 different nations, are presented in the context of wider social science research on low-carbon lifestyles. A key narrative is the need to move away from 'nudge' to 'think' approaches, and recommendations are made about how to move beyond small-scale and piecemeal approaches to behaviour change.	• Working closely with the CO research director, synthesized a range of research and reporting materials shared by the CASPI team • Lead report writer • Incorporated internal and external feedback into the report
3. 10 Principles for visual communication https://climatevisuals.org/blogs/climate-visuals-photos-video	Video + Tip sheet	Co-creation	This work, produced in collaboration with Resource Media, explores how to tell visual stories of climate change that will captivate audiences, whether it's through photography or video. A video and tip sheet were produced about ten key principles that work in both mediums, aimed at climate communications practitioners and other stakeholders.	• Provided feedback on the initial ideas, scope of the video, and then detailed feedback on the script (along with other collaborators). • Sound recordist for UK based audio • Image selection of Climate Visuals (CV) and matching images to the script.

4. Communicating Climate Impacts through Adaptation (Women's Institute project). https://climateoutreach.org/resources/guide-communicating-climate-impacts-through-adaptation-wi/	Workshop (report and video produced after my placement)	Co-creation + co-evaluation	Two workshops were tailor-made for the Women's Institute (WI) on the topic of public engagement with UK climate impacts. The workshops were designed to encourage WI Climate Ambassadors to engage with the idea that climate change is not just about recycling, and curbing your carbon footprint, but is also about preparing for, and being resilient to, the impacts expected from climate change now and in the near future (i.e. adaptation). Impacts from heat stress and flooding formed a key focus in both workshops, and participants took part in discussion and interactive exercises, with the aim to equip the ambassadors with tools to influence their local WI groups across the country.	• Co-designed the agenda of the workshops with CO staff. • Tailored presentation about engagement with flooding, incorporating my PhD work and research literature. • Helped to facilitate the workshops in Manchester and London
5. Climate health imagery survey (See chapter 7) Report: https://climatevisuals.org/blogs/air-we-breathe-climate-and-health-imagery Image Gallery: https://climatevisuals.org/images?f%5B0%5D=collections%3AHealth	Survey + Report	Co-creation	A nationally representative survey designed to investigate how the public engage with information and imagery relating to four key climate impacts facing the UK (heat stress; flooding; new and emerging diseases and air pollution). An experimental element allowed for comparisons between impact type as well as different image styles (no imagery; no people, people with neutral emotion; people with negative emotion), and questions allowed analysis on the key influences on behavioural responses. The findings are presented as *Chapter 7* in this thesis and were published as a CO report about communicating climate change as a health risk.	• Designed and conducted survey with £3000 budget granted by CO. • Led on analysis • Contributed a summary of the research to inform a new report about climate change and health. • Led to the development of a new Climate Visuals gallery based on findings.

As noted in the chapter introduction, while working on the qualitative analysis of the *Climate Communication in Practice* expert audit work (activity #1), practitioners' advocacy for co-production approaches and nurturing efficacy was salient. Given consistent findings about the importance of efficacy for promoting adaptive responses to climate change in my thesis (e.g. efficacy underpinned responses to flooding in *Chapters 3 & 4* and to other climate actions in *Chapter 6 & 7*), as well as the potential *efficacy* benefits of collaborative engagement, I was especially motivated to try to embed research findings and messages about efficacy into the activities I participated in. I thus attempted to embed efficacy in subsequent placement activities, where useful and relevant.

For the *Mainstreaming Low Carbon Lifestyles* report (activity #2), I wrote a section bringing together the existing research literature about efficacy; for the *10 principles* video (activity #3), I provided feedback on the script and tip sheet to build in a greater focus on balancing threatening impacts with solutions to develop efficacy. I also curated imagery for the video to match and support this theme (See *Figure 8.4.5* and *Figure 8.4.6* below). During the planning meetings for the *WI workshops* (activity #4) I suggested that a key aim for the sessions should be on nurturing a sense of efficacy amongst the participants. Finally, for the health imagery work (activity #5), I designed several survey questions to unpick the potential influence of efficacy in this domain (refer to *Chapter 7* for those results). Overall, I was certainly able to find ways to incorporate my findings and interest in efficacy into the activities, and this was received positively within the CO team.

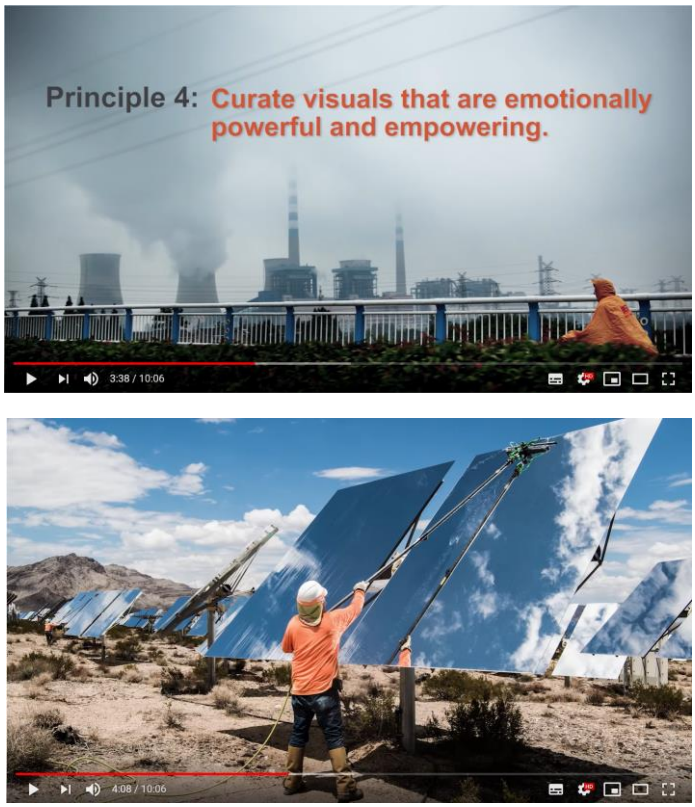


Figure 8.4.5 *- Screenshots of principle 4 from the "10 Principles" video (See Table 8.4.2 for link). The video notes the importance of balancing the seriousness of climate change with building a sense of efficacy. Above are examples of impact and solution focused imagery.*

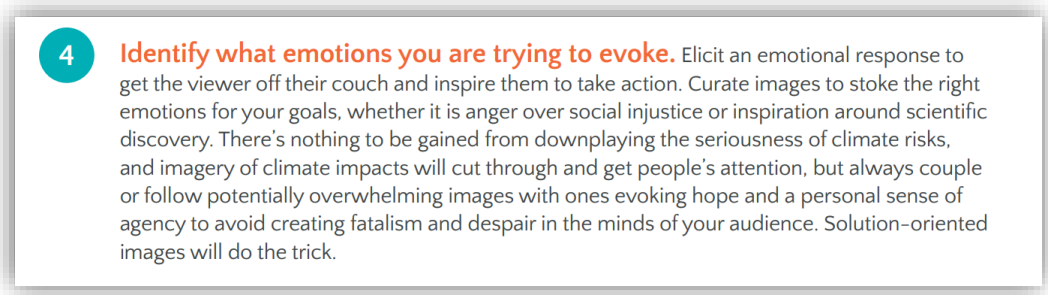


***Figure 8.4:6** - Principle #4 shown on the '10 principles' tip sheet[3] - An example of how content about balancing threat with efficacy was worked into the '10 Principles' project. Note how the tip highlights the need to balance overwhelming impact imagery with solution focused imagery.*

The WI workshops (activity #4) were especially relevant to this thesis work and make for some particularly useful reflections about best practices for nurturing efficacy via collaborative engagement. The aim for these workshops was to equip WI members with the skills and knowledge to communicate about UK climate impacts and to facilitate adaptive behavioural responses within their local communities and WI networks. The aims and objectives were conceived together between Climate Outreach and the WI, focusing on practical responses to flooding and heat stress (as these issues were deemed to be relevant to participants in different parts of the country). The collaboration thus represented a co-creation format with some continued co-learning and co-evaluation (after my placement had ended). Two workshops were held (one in Manchester, the other, London). The primary 'end-users' were WI Climate Ambassadors – WI members who were already interested in leading climate actions within their local branch. However, the project was broadly designed to benefit the wider WI membership as well, and following workshops CO developed a best practice guide for WI members (see: Shaw, 2019). In terms of my roles, I was invited to help with the workshop planning, facilitating and to give a tailored presentation of my thesis work about flooding as part of the workshops. A summary of my take on best practices for building efficacy, related to these workshops and broader activities at Climate Outreach, are presented in *Figure 8.4.7*.

[3] The tip sheet is available at: http://www.resource-media.org/wp-content/uploads/2019/05/Climate-Outreach-Resource-Media-Tipsheet.pdf

Figure 8.4:7 *- Recommendations for nurturing efficacy to respond to climate change impacts, through collaborative engagement activities*

One of the key takeaways from the WI workshops was the need to **let trusted in-group communicators take centre stage** to help build efficacy amongst partners. In my presentations about flooding, I discussed the importance of efficacy, and concluded with some messages aiming to encourage a sense of empowerment amongst the partners to tackle climate change. Although I received positive feedback about my workshop presentations (which are discussed below), from my perspective, I felt it challenging to directly nurture efficacy through the presentation. It felt a little strange saying to the WI partners that *"you can make a difference", "you're in a great position to make change"*, and *"your actions will have an impact"*. Being reflexive, I believe my positionality in the workshops as a researcher with little previous connection to the WI group limited my ability to foster efficacy. The message was right, but the messenger was perhaps wrong.

What appeared to be much more effective was when WI members gave presentations about their experiences as a climate ambassador within their local community, and the successes (and challenges) they had faced in trying to make change. The *'efficacy of the efficacy message',* so to speak, felt greater when trusted in-group members took the lead and had plenty of time to **share real world success stories.** In one example, a WI member had successfully encouraged their local MP to attend a climate change event, and through repeated intervention managed to convince the politician to host several public meetings within their constituency (see: Shaw, 2019: 24). In another example, a WI member spoke about their experiences of engaging other WI members with climate change – providing specific examples about what sorts of messages often worked and which didn't. For instance, they used

the Hockey Stick graph to counter misinformation and scepticism, and hosted tailored events, such as a bake sale. Compared to my presentation which disseminated research about the role of efficacy in flood affected communities, the WI-led presentations actively nurtured, from the perspective of in-group members, both self-efficacy and response efficacy. In other words, the partners communicated, very convincingly, that other WI members can do *something personally*, and that *actions can successfully create desired changes*. This is not at all to say that researchers should not be a focal point during co-created activities, but rather that having speakers provide concrete, relatable examples from an in-group perspective was particularly valuable.[4]

Figure 8.4:8 *- Snapshot of a WI ambassador nurturing a sense of efficacy, during the London workshop. This is from a video about the events, encouraging others to join the scheme. (See Table 8.4.2 for link to video).*

These recommendations make sense in light of the growing literature around the importance of trusted communicators in engaging specific audiences on climate change. Information about climate change is filtered through a range of factors, and *who* is doing the talking is one particularly influential factor. For instance, research has highlighted the *'Francis effect'* – where the Pope's encyclical on climate change led to significant increases in concern amongst Catholics (Maibach et al., 2015). Other research has shown that in U.S. communities where local TV weather forecasters frequently report on the climate crisis, members of the public are more likely to think climate change is personally relevant (Maibach et al., 2017). This also fits with theory and evidence concerning the roles of vicarious learning and social persuasion in enhancing self-efficacy related to threats, such as flooding (Bandura, 1994; Seebauer & Babcicky, 2020). More broadly it also again seemed to demonstrate a need to **balance impacts with solutions**, to appeal to both threat

[4] A similar point is made in the workshop follow-up document: Shaw (2019).

and efficacy beliefs, as suggested by research on protection motivation theory (e.g. Floyd et al., 2000). Together, this highlights the importance of learning about solutions from others, especially trusted, credible messengers in the context of climate adaptation.

Another challenge for researchers is to ensure an activity is engaging, while also accurate and stays true to the research. A challenge here is about how the nuances of research are potentially at risk of being lost through Phronesis, while tailoring to partners' needs, interests and level of expertise. In turn, a key recommendation here is to plan ahead, to **avoid technical jargon and co-create tailored language**. This can involve identifying engaging alternative terms and phrases that remains true to the meaning and implications of the research. *Table 8.4.3* provides some examples of alternative terms for different types of efficacy (following feedback from a co-organiser that such terms are too technical). This table represents a closing of the co-learning feedback loop, as the table contains some phrases that WI partners used themselves during the workshops. Though arising from tensions caused by Phronesis, in practice, this highlights another advantage of collaborative activities – that they give researchers a chance to pick up very specific phrasings that make sense to diverse end-users. Given the importance of language and framing in climate engagement (e.g. Corner & Clarke, 2017a), this suggests that co-creation of the right words, and narratives for specific audiences can be an important outcome of collaborations.

Table 8.4:3 *- Examples of translating research into engaging alternatives*

Academic Term	**Alternatives**
Self-efficacy (Feeling personally able to carry out certain actions)	I can do it / you can do it Feeling empowered Having a sense of agency Believing in your own ability Having the capacity to change Your capability Making a difference It doesn't matter that you're small, you can still make an impact
Response-efficacy (Belief that actions will bring about the desired outcomes)	It will work It will make a difference Believing solutions will be effective Thinking that the results will be good Beliefs about the success of actions
Collective-efficacy (Feeling that together we can achieve the desired change)	Together we can do it We can make a difference together Feeling that change is possible when we come together The power of groups Empowerment through collaboration

Another related suggestion is to **use narratives and metaphors** as part of the activity – which can be complimented with visuals. The science communication literature recommends using concrete examples, metaphors, and the *active* rather than *passive* tense to communicate complex ideas (e.g. Castellini et al., 2007). In my workshop presentations, rather than starting with research findings, I decided to give a narrative introduction – telling the story about the collapse of Pooley Bridge in Cumbria, during the winter 2015/16 floods. Making the story somewhat light-hearted, I highlighted that when a group of flood managers and politicians came to meet with the locals – they arrived at the wrong side of the broken bridge. With visuals on screen, I developed this into a visual metaphor to highlight that there has been a broken bridge around public engagement with climate adaptation (see: Smith, 2016). I then spoke about the need to 'rebuild the bridge', using different evidence-based strategies, like nurturing efficacy (see *Figure 8.4.9*). Thus, I was using a visual metaphor to highlight the importance of Phronesis for climate engagement, in a light touch way. I received some great verbal feedback from partners about this during the sessions. On reflection, this metaphor can also be interpreted as a somewhat Latourian dismantling of the dualisms 'public:expert', and 'experiential:academic', in the context of facilitating responses to climate impacts (see: Latour, 2012).

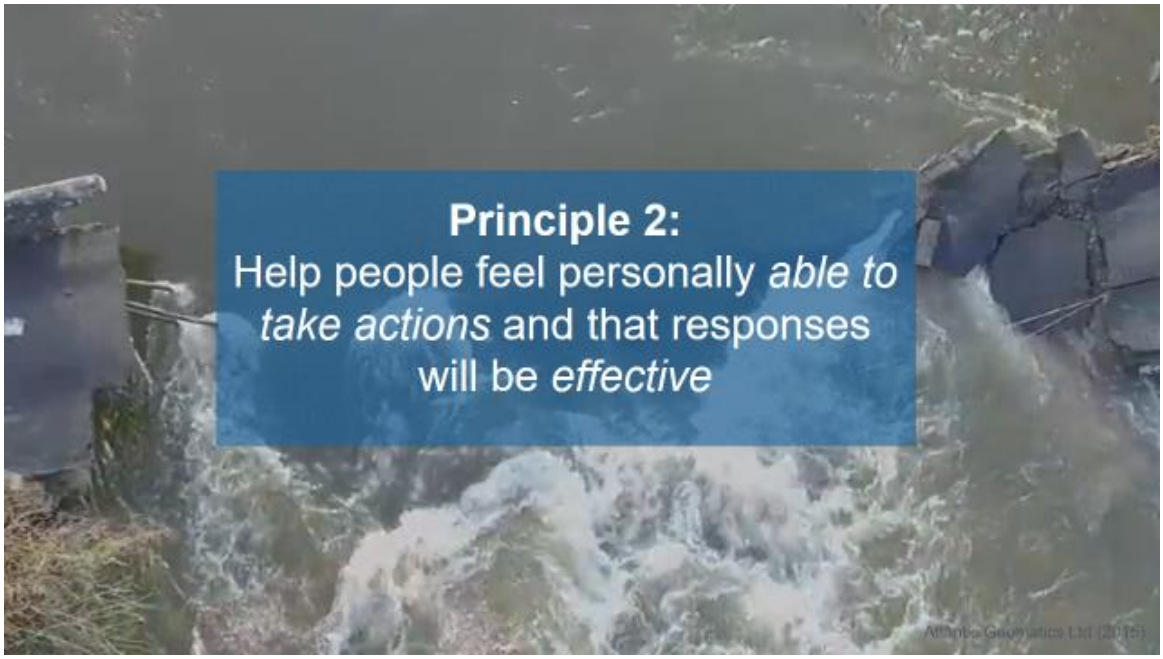


Figure 8.4:9 *- A slide from my presentation at the WI Climate Ambassador workshops, which shows how I used a visual metaphor of the Pooley Bridge collapse, and non-technical language to communicated the principle of efficacy. Original Image: "Pooley Bridge Collapse", by Atlantic Geomatics (UK) Ltd. Image reproduced with permission.*

Through the workshops, I also realised the importance of **curating and co-creating engaging imagery** as a two-way process. First, during my presentations, the imagery I curated seemed to underpin people's emotional reactions. When I showed transitions of imagery depicting Cumbria before and after the floods, there were audible gasps from the audience. Partners were noticeably moved by the imagery, and it's hard to imagine a similar response if it was just a verbal presentation. This seemed to validate the 10 principles tip sheet we co-created (activity #3) prior to the

workshops, and the related Climate Visuals principles, which guided my selection of imagery (e.g. show emotionally powerful impacts; show local but serious impacts; show real people; tell new stories; see: Corner et al., 2015).

Second, there were clear benefits of including creative tasks in the workshops too. Partners were given space and time to co-create posters that could be used in their local WI networks, to communicate climate impacts (See *Figure 8.4.10*). On reflection, the collaborative act of co-creating imagery appeared to produce meaning in multiple ways. Imagery creation simultaneously provided an emotive focal point for messages; time to process new information together; opportunities for partners to translate information into personally relevant symbols, messages and languages; and potentially reinforced a greater sense of collective efficacy. Although somewhat speculative, such effects would fit with research mentioned earlier, which demonstrated that the co-creation of murals can contribute to changes in community pro-environmental attitudes around conservation. Previous work has also shown that photo-elicitation, a form of creative co-creation through research, can generate knowledges and insights that differ from conventional interviews, focus groups and questionnaires (O'Neill & Graham, 2016). The co-creation of imagery is something I have advocated previously too, as it appears to be an avenue to create very inclusive, highly tailored framings and representations of climate change, imbued with direct meaning for those involved (McLoughlin, 2015). Thus, it seems beneficial to allow time and space to curate and co-create engaging imagery in similar activities.

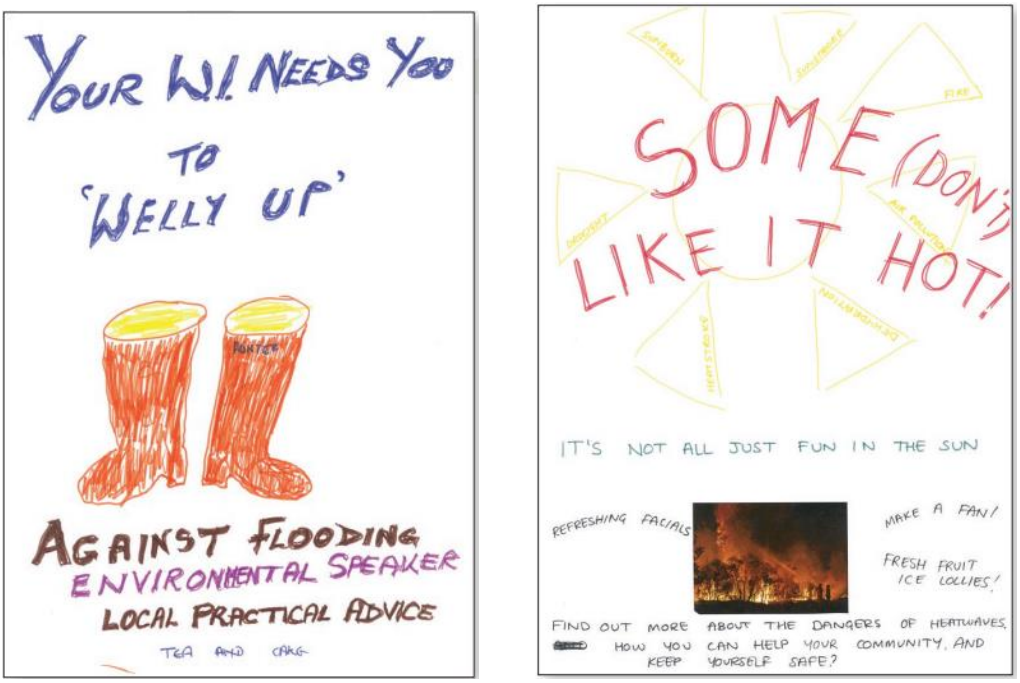


Figure 8.4:10 *- Examples of posters created by WI Climate Ambassadors during the workshops to communicate flood and heat risks in their local community. Sourced from: (Shaw, 2019: 20 - 22).*

In terms of feedback, the workshops were appraised very positively by WI partners involved. When feedback was given at the end of the sessions from WI members, some of the ambassadors explained to the room how 'empowered' they felt coming away from the day. This suggests that a notable increase in efficacy had occurred

through the co-created activities.[5] However, without any concrete empirical evidence (e.g. measured pre-to-post), it is hard to disentangle exactly which parts of the workshops created a shift in efficacy. My speculation is that the combination of all the efficacy building principles detailed above, within a social learning environment, led to such changes. This suggests the importance of layering up different approaches together to nurture efficacy.

Overall, while I was able to help embed efficacy messages into the collaborative placement work, there are also some challenging questions to reflect upon: How is 'embedding efficacy' any different to simply disseminating findings in a manner that's actually down near the bottom of the co-production ladder (i.e. educating or informing)? Should researchers or practitioners aim to embed messages of these sorts, and frame messages to achieve certain ends, if they have not necessarily arisen as a co-created aim? Did my own ambition to embed efficacy into activities disrupt the balance of co-creation, shifting it from being a 'two-way' activity to 'one-way'? If so, what should the role of the climate communications researcher be in these circumstances - *Informer*? *Listener*? *Motivator*?

These questions relate back to the tensions concerning the balance of research and action within PAR (Reason & Bradbury, 2001). Having reflected on possible responses to these questions, a clear way to resolve the tensions is to view 'the researcher' as being a *bridge between academic and experiential knowledge*, with research insights that *can potentially prevent harm to people now and in the future*. The researcher is thus an essential agent within the phronetic relationship, and should take opportunities to help facilitate change, when people are at risk from climate impacts. From this perspective, with knowledge of the consistent, motivational role of efficacy, it seems that *not* taking action to nurture efficacy is more problematic; and the tensions posed by the question above become quite insignificant.

8.5 Conclusions

This chapter has critically reflected upon the nature, forms and processes of collaborative engagement from a participatory action research perspective. The chapter initially distinguished between the range of different styles of participation and collaboration, developing previous conceptualizations of co-production, adding some clarity about when different models are suited to practitioner needs.

The chapter goes some way in demonstrating that highly collaborative approaches to engagement can offer a range of benefits in the realm of climate change communications. My experiences validated the idea that collaborative engagement offers a positive alternative to typical one-way approaches to information dissemination and can be valuable when aiming to facilitate adaptive responses to climate change. The co-created placement activities appeared to offer a range of benefits through two-way learning experiences that also seemed to increase the self-efficacy of the end-users and partners involved. My experiences with Climate Outreach and the WI workshops were extremely positive, and this was helped by our

[5] CO also continued to receive positive feedback about the WI best practice guide (Shaw, 2019). The head of public affairs for the WI commented that the *"guide has given the WI's Climate Ambassadors a solid understanding of climate change and the confidence to talk about it with others".* Again, this suggests a positive influence on self-efficacy amongst WI members. See: Climate Outreach (2019: 4).

goals, interests and motivations being highly aligned throughout. In other circumstances, participatory approaches may have some potential challenges, particularly if there are some conflicting stakeholder goals and biases that must be navigated. Practitioners should therefore reflect on this before carrying out similar activities, and this chapter can hopefully help with that process.

8.1.6 Reflections on strengths and limitations

This chapter applied a participatory action research approach to explore ideas related to collaborative engagement. While points raised in this discussion cannot be fully conclusive in terms of cause and effect, the benefit of this approach was that it allowed for reflection on practical experiences, and reflexivity around my position as a researcher during real-world communications activities. Such reflexive discussion is not typically a focal point in positivist-oriented research but allowed new ideas and important parts of climate communication to be considered in detail. The insights presented had credibility and trustworthiness (Bryman, 2012), given the placement involved a broad range of activities, that were highly relevant to the aims of this thesis. Overall, this chapter has helped to generate theoretical knowledge surrounding the processes and dynamics of collaborations, and some useful insights that can inform real communication practices.

8.1.7 Key implications for climate change communication

In summary, the key recommendations for collaborative climate change communication activities following the critical reflection in this chapter are:

1. **Consider the form of participatory or collaborative engagement that is best suited to you and your partners' needs.** A more nuanced appreciation of the differences between participatory approaches may be needed within the field of climate change communications. Practitioners can use the decision tree in this chapter as a guide to planning and decision making. Practitioners and partners should reflect on whether they wish to co-create aims, include a substantial element of two-way learning, problem solve together, deliver outputs together, and continue a longer-term co-learning and co-evaluation relationship.

2. **Consider the potential benefits and risks that could be involved:** Highly collaborative approaches can bring benefits, such as better relationships, services, and increases to efficacy. However, it's worth considering possible costs, and how these might be negotiated if they arise. In particular, it's worth reflecting on whether the partners' aims and interests are aligned; and how to negotiate possible tensions.

3. **Layer up best practices to build efficacy:** Practitioners should allow space and time for trusted in-group led elements during activities (e.g. sharing success stories). They should use and co-create language, visuals and metaphors that are engaging yet stays true to the research; and overall, work with users' needs and interests to tailor a high-quality collaboration that bridges the gap between academic and experiential knowledges.

Chapter 9

Discussion

Image: "Tree planting" by Alex Indingo is licensed under CC BY 2.0

9.1 Introduction

This chapter explores the key theoretical and practical contributions from across the thesis. In other words, *what is known now this empirical work is complete? How does this relate to, and build on, past research? And, what are the practical implications for practitioners communicating climate change adaptation?* In the thesis introduction *(Chapter 1)*, it was identified that, given limits to adaptation behaviour and effective communications at present, a greater understanding of both the psychology of adaptation behaviour, and communications to promote adaptation, were needed. It was argued that by better understanding the underlying factors that promote adaptation, communication interventions could be better framed to tap into, or harness the influence of the most salient factors and mechanisms. In turn, this could help to facilitate adaptation efforts. Given this, the thesis work set out with three key aims:

1) To advance knowledge about the factors that influence adaptation behaviour.

2) To advance knowledge about how communications can be optimised to promote adaptation.

3) To provide clear recommendations for practitioners who communicate with the public about adaptation.

The first two of these aims had a theoretical focus, and the third aim had a practical focus. This chapter is organised in relation to these aims.

In the literature review (*Chapter 2*), several threat, coping, and other socio-cognitive factors were identified as being potentially relevant to adaptation behaviour at the individual level. These variables fall within categories of *threat appraisal* (risk perceptions, negative affect, and direct experience), *coping appraisal* (efficacy, perceived costs) and *other factors* (social norms, values, place attachment and trust). While some of this past research has been quite consistent (e.g. risk perceptions are broadly found to be influential, with some exceptions), there have been mixed findings for other variables (e.g. direct experience, negative affect), and research concerning some variables has been quite limited (e.g. values).This thesis has added to the evidence base about such factors, by exploring their influence, particularly in relation to flooding and public health.

At the same time, the literature review also highlighted that, while there has been very little research about communicating adaptation specifically, some factors appear likely to determine the effectiveness of communicating adaptation. These included threatening vs. non-threatening request styles, use of evidence-based visuals, and collaborative engagement, such as co-production. Broadly, past research related to both climate change and health communications suggests that inducing a balance between a sense of threat and efficacy is desirable; however, some work suggests that criticism or the threat of overwhelming social pressure can drive behaviour change too. This raised a broad question: *'to threaten or not to threaten?'* This thesis has therefore attempted to address this question and provide some clarification. Specifically, *Chapters 3, 5, 6, 7* and *8* gave insights about communications effects.

In turn, Protection Motivation Theory (PMT) was identified as a relevant theoretical framework; given it proposes that behaviour is influenced both by threat appraisals (i.e. perceived susceptibility and severity) and coping appraisals (i.e. self and

response efficacy, and perceived costs) and also due to its use in health communications. This model selection was validated through qualitative work in *Chapter 3*, which pointed to the importance of efficacy in the context of flood recovery. However, the PMT model appeared to have some major limitations. Certain variables, such as collective efficacy, reactance, social norms, values, and direct experience, which were potentially relevant to adaptation behaviour were absent. The model also lacked clarity about the influence of communication factors. Responding to the aims, and building on the limitations of PMT, this thesis work has advanced research about the factors at the individual, behavioural level; as well as the communications level. The following sections discuss the key contributions, organised into theoretical and practical sections.

9.2 Theoretical contributions

9.2.1 Key contribution #1: Efficacy is consistently influential, and its pathway varies with response level

Perhaps the most substantial theoretical contribution of this work is that it has advanced our understanding about the role of *efficacy* in relation to the communication of climate adaptation. Across several studies, this thesis has consistently found evidence for the key role that efficacy plays in promoting adaptive responses to climate change. In *Chapter 3*, efficacy was found to be a highly salient, yet threatened, psychological need amongst flood victims. In *Chapter 4*, self-efficacy, response-efficacy and collective efficacy were each shown to influence personal, policy and social level responses to flood hazards (respectively) – and internal political efficacy (i.e. feeling well informed about political affairs related to hazard management) was also associated with climate action. In *Chapter 6*, self-efficacy was predictive of intentions to take adaptive behaviours related to flooding, energy and transport, following climate relevant campaign messages. In *Chapter 7*, both self and response efficacy were influential in promoting adaptive action intentions in response to climate health impacts. And, *Chapter 8*, demonstrated that climate change communications experts tend to advocate efficacy-building engagement (before exploring how to achieve this through collaborative engagement).

Prior to this work, it was known that behaviour in response to various environmental and health threats is often influenced by both threat and coping appraisals at the individual level. Past research has broadly shown that a balance between heightened threat and efficacy beliefs tends to lead to adaptive responses to threats, while an overwhelming sense of threat combined with a lack of efficacy can lead to maladaptive responses (e.g. Floyd et al., 2000; O'Neill & Nicholson-Cole, 2009; SWOV, 2015; Witte & Allen, 2000). The golden thread of efficacy in this thesis is therefore consistent with a range of research that has illuminated efficacy as an important antecedent for behaviours aimed at reducing the negative impacts of health threats and stressful life circumstances (e.g. Bandura, 1977; Floyd et al., 2000; Rogers, 1975). The thesis is also consistent with research specifically showing a positive relationship between efficacy and climate adaptation behaviour (Botzen et al., 2009; Botzen & van den Bergh, 2012; Bubeck et al., 2013; Terpstra et al., 2009). This also includes work published during the thesis writing, showing efficacy, and the related concept of 'agency', influence coping in the aftermath of flooding events (e.g. Fox-Rogers et al., 2016; Walker-Springett et al., 2017); and a meta-analysis, again highlighting the importance of self and response efficacy as key determinants of individual adaptation behaviour, across a range of contexts (van Valkengoed & Steg,

2019). This thesis therefore adds further weight to this literature, showing the importance of efficacy beliefs in facilitating adaptive responses.

Yet, building on this research, the findings of the present work also adds some new insights around efficacy as well. First, while *Chapter 3* found that self-efficacy and response-efficacy (and potentially collective efficacy) were salient in the context of flooding, models such as PMT have done little to explain when and how different forms of efficacy relate to climate adaptation. While previous research has explained that self-efficacy beliefs promote attainment of individual-level goals (e.g. Bandura, 1977), and limited applied work has shown that collective efficacy can be influential for adaptation (e.g. Thaker et al., 2016), this thesis is the first time the distinctive relationship between efficacy type and response level has clearly been demonstrated for climate adaptation. While some research has hypothesised that self-efficacy relates to the intra-psychic level and collective efficacy relates to the inter-psychic level, such work has only provided this as theoretical suggestions to date (Yaakobi, 2018).

In turn, *Chapter 4* showed how different forms of efficacy - *self*, *response*, and *collective* - are influential for different levels of responses at the *personal*, *policy* and the broader *societal* level, respectively. By doing so, this work adds clarification about why people take personal, protective actions towards proximate or direct threats, like flooding or health (they "feel personally able to do so"); support adaptation-relevant policies (they perceive such responses as being "effective"); or engage in activities about climate change that demand broad social transitions (they perceive that "together change can be brought about"). These effects seemed to hold true whether the problem-focused coping was adaptive (e.g. household flood protection) or maladaptive (e.g. dredging support when ineffective). Also, unlike past research that has suggested that collective efficacy outweighs the influence of self-efficacy for problem-focused coping with environmental stressors (Chen, 2015), or that the effects of collective efficacy on behaviour are mediated by self-efficacy (Jugert et al., 2016), this work has added clarity by showing that different forms of efficacy will have influential, direct effects *depending on the type of response being taken*. The thesis has also contributed new insights about how efficacy can be influenced, in the context of adaptation, as discussed in the following section.

9.2.2 Key contribution #2: Non-threatening communication approaches can nurture efficacy and facilitate adaptive responses amongst the public

Building on the above contributions about efficacy as a facilitator of adaptation behaviour, this thesis has also shed light on the ability of communications to either promote or inhibit people's efficacy beliefs. Past research specifically about communicating to influence efficacy in the context of adaptation is very limited, except for a few studies (e.g. Kievik & Gutteling, 2011). Thus, given the clear importance of efficacy, contributions on this topic were much needed.

First, this research has shown that efficacy can be *negatively influenced* by engagement practices, leading to negative outcomes. *Chapter 3* illustrated, via qualitative analysis and sequential feedback loop diagrams, how self-efficacy can be inhibited by external barriers (such as intervention by authorities), leading to anger, maladaptive responses, and potentially reactant responses. In turn, *Chapter 6* has demonstrated causally, that freedom threatening communication styles diminish self-efficacy and response-efficacy beliefs, relative to a non-freedom threatening

communication style. Specifically, the experimental study showed that threatening message styles (i.e. “you must do…”, “it’s disgusting if you…”) were particularly detrimental for efficacy outcomes. To our knowledge, this is the first demonstration of such an effect of communication style on efficacy outcomes. While other research has explored how *agency* can be negatively implicated by the management of authorities in the context of flooding (Walker-Springett et al., 2017), this work makes more explicit the potentially negative implications of communications for different forms of efficacy, in the context of adaptation.

Usefully, this thesis has also shown how efficacy can be *increased* through communication. Past research has suggested that self-efficacy can, in general, be increased through vicarious learning, mastery, and verbal persuasion (A Bandura, 1977). In the context of climate adaptation, one experimental study has reported an increase in participants’ self-efficacy in response to efficacy-framed information about flooding (Kievik & Gutteling, 2011). This thesis has built on such work by showing that efficacy related to adaptation behaviours can be fostered by employing a non-threatening communications style, solution focused imagery and collaborative engagement. *Chapter 6* showed very clearly that non-threatening messages that emphasise a freedom to choose (“you have a free choice to”) were better for promoting adaptive responses. Specifically, non-threatening messages led to higher self and response efficacy outcomes than a threatening style, as well as lower freedom threat, more favourable campaign attitudes and higher behavioural intentions. This was important because higher self-efficacy (along with lower freedom threat, positive campaign attitudes, and higher prior issue importance) positively influenced behavioural intentions across the campaigns. By looking at efficacy outcomes this work has extended past research which has tended just to measure perceived freedom threat, or behavioural outcomes in response to threatening communications styles (e.g. Dillard & Shen, 2005; Kronrod et al., 2012).

Moreover, while past research has broadly shown that solution-focused imagery can increase a sense of self-efficacy and that impact imagery can reduce a sense of efficacy (Metag et al., 2016; O’Neill et al., 2013; O’Neill & Nicholson-Cole, 2009), this work is of the first to show that a similar effect translates into the realm of health framings of climate change. *Chapter 7* showed that efficacy was higher in response to solution-focused, versus impact-focused, health imagery. However, this contrasts with one study which did not find impact imagery reduces efficacy (Hart & Feldman, 2016). Additionally, this thesis work has shown that efficacy is likely to differ according to different types of impacts. *Chapter 7* highlighted that self-efficacy in relation to air pollution was substantially higher than heat stress, disease, and flooding impacts (discussed further below). This is important, because meta-analysis (e.g. van Valkengoed & Steg, 2019) and other work about public perception of various climate impacts (e.g. Steentjes et al., 2020) have not distinguished how efficacy beliefs may differ according to specific impacts.

Furthermore, *Chapter 8*, is of the first studies to argue specifically that collaborative engagement approaches, such as via co-production or co-creation, are likely to increase participants’ sense of self, response, and collective efficacy. Collaborative approaches appear to encourage efficacy when trusted in-group communicators can take centre-stage, share success stories, and activities include opportunities to co-create personally relevant meaning, imagery and language. This latter point extends past research concerning the benefits of co-production broadly and for climate

engagement (e.g. Howarth & Morse-Jones, 2019; Vanleene et al., 2015), by making links to efficacy and exploring the process of 'efficacy nurturing' collaborations.

In addition to influencing efficacy, the importance of non-threatening requests was also demonstrated in relation to freedom threat. Past research has suggested that when individuals believe their freedom is inhibited, this can lead to rejection of persuasive communications, anger and maladaptive coping in counter to behavioural requests (Brehm, 1966, 2000; Dillard & Shen, 2005). Research in environmental communication has previously demonstrated the importance of reactance and freedom threats (e.g. Kronrod et al., 2012; Murtagh et al., 2012), and scholars have suggested a role of reactance for responses to climate hazards (Gifford, 2011, see also commentary in Dengate, 2019). However, the present work is of the first to specifically provide evidence of effects in relation to adaptation and its communication. Through qualitative work, *Chapter 3* suggested that freedom threat might have led to reactance in relation to engagement from authorities involved in flood management. While *Chapter 4* found no significant effects of trait reactance on flooding and climate responses (i.e. having a general tendency to reject freedom threats), *Chapter 6* found that a cognitive *state* of freedom threat was both directly induced by threatening communications, and that freedom threat significantly influenced behavioural intentions. This suggests an important role that transient levels of freedom threat play, and how they can be influences by communications style.

It should be cautioned that the present work was *not* longitudinal and is therefore not able to confirm if highly assertive, or threatening communication styles are more likely to drive social change, if repeated over longer durations. In turn, some researchers have recently advocated a layered approach, whereby people can influence environmental and social transformations through both threatening and non-threatening practices. O'brien et al., (2018) argue that people can affect change through a combination of three types of dissent: (1) *dutiful dissent* (i.e. working within existing systems to express discontent) (2) *disruptive dissent* (i.e. actions that explicitly challenge power relationships, such as protests and collective activities), and *dangerous dissent*[1] (i.e. imagining alternatives that threaten vested interests and the status quo). Given the clear influence of social movements throughout history, it seems reasonable that a combination of disruptive and less-disruptive approaches may alter social norms and influence power brokers. A combined approach in relation to broader social change should be tested further empirically, and over time. However, according to the present work, threatening communications, especially those which undermine efficacy and other psychological needs, can ignite substantial maladaptive responses. They are therefore not advisable for communicators aiming to encourage other people to engage in adaptation behaviours (including collective actions and policy support, which may in turn, lead to changes in social norms and power structures). Instead, non-threatening requests are recommended, given they consistently elicited more favourable responses, and crucially, higher efficacy.

Together, these findings show how efficacy and other salient psychological factors can be implicated by the extent to which request styles in communications are threatening or non-threatening. These findings are important because they can help

[1] As noted by O'brien and colleagues, dangerous dissent is "not be confused with the dangerous methods sometimes used to display dissent, such as violent riots of rage and extreme or fundamentalist attacks"

climate communication practitioners to address some of the core socio-cognitive mechanisms that promote adaptation. Previous study has shown that, in relation to climate mitigation actions, personal and collective efficacy beliefs are limited in Britain and across several other European countries (Fisher et al., 2018; Poortinga et al., 2018). While there may be some demographic and age-group differences in efficacy (e.g. younger age groups in Britain are more likely to perceive collective climate action to be effective – see Fisher et al., 2018) increasing efficacy is likely to be a no-regrets approach. Without nurturing efficacy, communications are more likely to promote maladaptive responses when the perceived threats of climate impacts are also heightened (Peters et al., 2013). Furthermore, there is evidence communications are not yet sufficiently addressing efficacy (as discussed later). Together, this redoubles the need to nurture greater efficacy to facilitate adaptive responses to climate change via non-threatening communications characteristics.

9.2.3 Key contribution #3: Threat appraisals also influence behaviour and are shaped by impact framing

While a non-threatening communications *style* is advisable, this does not mean the *perceived threats of hazards* are unimportant, as is discussed in the following section. In addition to the role of efficacy, this work has added evidence around factors related to threat appraisal. As noted above, a threat-efficacy balance forms the cornerstone of the PMT model and prior to this thesis, these two factors together have frequently been shown to promote problem focused coping in response to health threats, and fear appeals. Threat appraisals have also been shown to be influential in a number of studies about adaptation behaviour (e.g. Botzen et al., 2013; Brügger, Morton, et al., 2015; Bubeck et al., 2012; Feng et al., 2017; Grothman & Reusswig, 2006; Reynaud et al., 2013). Aligning with this previous work, the thesis has found *risk perceptions* (i.e. perceiving personal vulnerability and impact severity) to be consistently influential for adaptation behaviours, alongside efficacy. This work has shown via regression analyses in both *Chapter 4* and *Chapter 7* that *climate change concern* is also an important aspect of risk perceptions, directly influencing adaptation behaviour. Like most previous research, a positive relationship existed for these variables, whereby greater perceived risks increased intentions to act.

However, this work has added some new insights here as well. First, a comparison of regression models in *Chapter 4* suggested that the salience of threat appraisals seemed to be determined by the type of response options at hand. While risk perceptions and climate concern influenced *behavioural* responses, threat appraisals were non-significant for policy support. In this sense, feeling a personal sense of threat seemed to drive *behaviours* but not responses at the policy level. Instead, policy support was influenced largely by *response efficacy* (as noted above). Thus, it appeared that where responses are external, and largely out of personal control, a sense of threat is relatively less important. This suggests a limitation of the PMT model, when anything other than a personal behaviour is being considered. Scholars have suggested that non-significant or negative findings related to risk perception may be the result of some methodological issues, such as measuring present risk perceptions to predict past behaviour (see: van Valkengoed & Steg, 2019). However, the present findings highlight that it may also be due to the type of response being assessed. This suggests that *risk perceptions alone are not enough to produce all forms of adaptive responses to climate change*, and perhaps suggests a greater role of efficacy given at least one form of efficacy was significant irrespective of response type. Nevertheless, further research would be needed here, as in *Chapter 7*, threat

appraisals significantly predicted an outcome variable that aggregated together personal-level and policy-level responses.

This thesis has also indicated that different types of climate hazards are not appraised as being equally threatening. In *Chapter 7*, threat of impacts relating to flooding, heat stress, new and emerging diseases and air pollution were appraised differently – with air pollution eliciting substantially higher threat appraisals and negative affect. Heat stress was viewed with as less threatening and concerning. This fits with research that shows air pollution is a particularly salient risk compared against climate change as a broader issue, and other impacts like flooding (Hart & Feldman, 2018; Whitmarsh, 2008), but contrasts with recent findings that heat stress is an increasingly salient risk in the public mind (Steentjes et al., 2020). This adds to evidence that appraisals of climate health impacts are heterogeneous, given the different impact manifestations elicit distinct appraisals (Kotcher et al., 2018). Nevertheless, though climate threats can be appraised differently, insights from *Chapter 7* suggested that threats which implicate basic human needs (e.g. to breathe) and are not geographically limited, tend to be more threatening. Thus, the threat appraisal appears to be mediated by the value ascribed to threatened phenomena (as discussed below).

Together, one could take from this that communicators should aim to heighten threat appraisals, through health framings that implicate basic physiological needs. However, this should be done with care given meta-research around health behaviour has found that threat appraisals only lead to action when efficacy is also high (Peters et al., 2013). Communicators should therefore aim to ensure a balance between threat and efficacy is created. However, while this is crucial, evidence suggests that communications to date have not been achieving this balance (see practical contributions below). Furthermore, while the present work shows that threat appraisals do influence behaviours alongside efficacy, the context is also crucial. Not all adaptation responses seem to involve the same influence of threat appraisals, and different impacts elicit different levels of perceived risk.

9.2.4 Key contribution #4: Perceived minority status and descriptive social norms influence adaptive responses to communications

Another cross-cutting theme of note was about the role of descriptive social norms and one's perceived majority-minority position**.** *Chapters 3* and *4* highlighted majority support for dredging leading to a focus about how majority versus minority status may influence responses following threatening communication interventions. While much previous work has shown an influence of descriptive social norms on pro-environmental behaviour, this thesis has added some further insights. Specifically, it has shown two distinct processes influence behavioural responses in the context of adaptation:

1. Perceived descriptive social norms influence behavioural intentions
2. Perceived position in the minority, determined by current personal behaviour, influences response to communication

While previous work has suggested there can be 'divisional effects', whereby larger groups diffuse the influence of persuasive communication amongst group members (Latané, 1996; Latané & Wolf, 1981; Sedikides & Jackson, 1990), this effect had not been assessed in terms of majority versus minority distinctions, or in relation to climate change. While an effect of norm status was not found in a lab setting in *Chapter 5*; a follow up in *Chapters 6* presented good evidence that 'behavioural

minorities' viewed campaigns more favourably and were more likely to change behaviour, compared to a control group. Taken alongside evidence from *Chapter 7* which showed that descriptive norms were influential for adaptive responses to climate health impacts, this suggests a key role of conformity influence for adaptation (Cialdini & Trost, 1998). This finding aligns with other work in adaptation and pro-environmental behaviour which highlights an influence of descriptive social norms on behaviour (Cialdini & Trost, 1998; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008; van Valkengoed & Steg, 2019).

The findings however did not support the idea of a 'divisional effect', given that the majority groups did not significantly differ from the control or minority conditions across the two studies. Furthermore, while normative status was significant in *Chapter 6*, the effect sizes were smaller than how threatening the communication style was, and the request type (i.e. reduce vs. stop), for determining responses to campaigns. This adds further weight to the idea that non-threatening approaches to communications are especially important, building on the limited research that has tested effects of assertive environmental communications (Kronrod et al., 2012; Murtagh et al., 2012). Nevertheless, based on the present research, it seems reasonable to conclude that climate behaviour is influenced by descriptive norm information because *being in the minority is threatening.* Overall, this extends research about the more nuanced threats of climate hazards toward social values (such as the value 'belonging' - see: Graham et al., 2013), given this research suggests that there can also be a social threat of being outside the norm, in terms of one's adaptation behaviour.

9.2.5 Key contribution #5: The perceived threat of coping limits adaptive responses

This research has also shed light on the role of perceived costs of coping responses related to adaptation; In other words, the importance of when *coping responses themselves may be perceived to be threatening*. The PMT model explains that the perceived costs of taking actions can negatively influence behavioural intentions, and this influence has been evidenced in meta-analysis considering a broad range of health behaviours (D. Floyd et al., 2000). Despite this, the role of perceived costs are suggested to be mixed for climate adaptation (van Valkengoed & Steg, 2019), and are under-researched relative to other factors, and have not been included in recent meta-analyses of adaptation (van Valkengoed & Steg, 2019).

The present research has made new qualitative and quantitative contributions around the role of costs for adaptation behaviour. In *Chapter 7,* the perceived costs of coping were shown in a national survey to have a direct negative influence on climate adaptation behaviours related to health impacts. This was convincing evidence that perceived costs do play an important direct role for protective climate behaviour, though one which is less influential than risk perceptions and efficacy variables.

This thesis work also expands on the literature, by showing that perceived costs can implicate responses to communications. In *Chapter 6*, requests to "reduce" current climate behaviours, rather than "stop" actions altogether, led to more favourable responses to campaigns. First, the pre-screening study in *Chapter 6* showed that requests to "start" a new behaviour were generally perceived to be most difficult. Then, reduce requests gave more favourable responses for all five outcomes variables measured in the main study (behavioural intentions, campaign attitudes,

freedom threat, self-efficacy and response efficacy). This can be explained as an issue of perceived costs of coping because the reduce options were viewed as less threatening, more achievable and more effective than stop requests. This makes sense, as reducing an activity does not require an absolute sacrifice of that activity altogether, or effort to take up an unfamiliar behaviour, and so, is perceived as less costly.

Perceived costs were also shown in qualitative work to play an important, yet quite complex role in personal responses to hazards. In *Chapter 3*, the perceived threat of certain coping options were made salient by flood victims, who discussed the negative aspects of having to relocate to a new area, due to the floods. One flood victim, for instance, explained that they wanted to continue living in their community, despite increasing flood risk, as moving somewhere else was appraised as a threat to their sense of belonging. This suggested that problem-focused coping options can also be appraised as threatening a range of complex psychological needs. Building on other research about decision making related to wildfire evacuation (e.g. Johnson et al., 2012), the present research has proposed the concepts of *threat dilemmas,* and *tipping points.* This contribution suggested a cognitive mechanism whereby the perceived threat of a specific coping option (e.g. relocating to another area), appears to be weighed up against the threat of the hazard itself (e.g. flooding), and that the trade-off determines action. In this sense, the 'balance of threats' between the hazard and coping options, could be viewed as acting like a seesaw, or scales (See *Figure 9.2.1*). The weight of threat on each side facilitates action, when a tipping point is breached

Figure 9.2:1 *- A diagram to illustrate how threat dilemmas may be weighed up in adaptation contexts. In this example, the perceived threat of relocating to a new area exceeds the threat of the flooding hazard, and therefore the individual is not anticipated to relocate to a new area.*

On reflection, this perhaps helps to explain why past research around perceived costs has been somewhat mixed. Research has previously suggested that perceived costs may play a more important role when adaptation measures are financially expensive, compared to inexpensive adaptation measures (van Valkengoed & Steg, 2019). While this appears likely, the present work also suggests appraisals of

perceived costs may also be more nuanced. The findings of *Chapter 3* suggest that (a) perceived costs can be quite holistic, taking into account threats to physiological and psychological needs (e.g. safety, belonging), and not just how expensive a coping response is financially, and (b) perceived costs of coping might be weighed up against the threat of the hazard itself (e.g. flooding) to determine action. In turn, it seems that past research has not fully explored these aspects of perceived costs. After conducting this research, I consider this to be a potential limitation of the PMT model and other research on adaptation to date, and further research could usefully address this. Irrespectively, the findings of this research together suggest a need to reduce the various perceived costs that may be associated with recommended adaptation behaviours.

9.2.6 Key contribution #6: Visual cues, simulation, and imagery help to facilitate adaptation

This work has also contributed novel insights into the visual dimensions of climate adaptation. Firstly, the importance of visual cues was suggested. The qualitative interviews *Chapter 3* and survey research in *Chapter 4* each highlighted the importance of visual cues in the context of flooding. Many participants relied on visual cues to guide their threat appraisals, and decision making during the flood events, relying on such cues more than official warnings. This aligned with survey research in Australia which showed that people often rely on visual cues in wildfire contexts (Handmer et al., 2019). Together, this suggests a substantial, but perhaps overlooked, role of visual cues within adaptation, warranting further research.

Being able to 'see' impacts by forming mental pictures was also shown to be important, for the general public, outside of hazard contexts. This work is of the first to empirically show a direct role of *simulation bias* for promoting adaptive responses to climate change. While it has been suggested that one's ability to form a mental picture can influence decision making (Kahneman et al., 1982), to date little research has addressed this directly as an antecedent of climate adaptation behaviour. In turn, *Chapter 7* found that simulation had a small but significant positive influence on adaptive behavioural intentions. And, people who viewed a cluster of images depicting people expressing negative emotions felt most able to form a mental picture of the impacts afterwards. Building on research which highlights the importance of visualising future adaptation (e.g. Sheppard, 2005), this work has demonstrated both the cognitive significance of simulation for climate adaptation, and provided some initial causal insights about how communications may influence simulation – warranting further investigation.

The research also provided additional insights about the ways that images can be employed to foster adaptive responses. *Chapter 7* demonstrated that images depicting poor air quality are viewed by the general public to be the most concerning and most representative of climate change, compared to other health impacts considered. As noted above, images of health *solutions* were also shown to generate significantly greater feelings of self-efficacy than images of health impacts. Together, this builds on past research about the visual communication of climate change impacts and solutions (Hart & Feldman, 2016; O'Neill & Nicholson-Cole, 2009), by extending this research to health impacts. Interestingly, *Chapter 7* also showed that participants interpreted imagery in terms of their implications for people, irrespective of whether people were depicted or not. This gives further weight to evidence about the importance of people-focused implications of climate imagery (Chapman et al., 2016).

Finally, building on other research which has demonstrated the epistemological and motivational benefits of co-creating imagery (O'Neill & Graham, 2016; Schneller & Irizarry, 2014), the present work has argued for the need to place emphasis on visuals within collaborative activities. Drawing on practical experiences, C*hapter 8* explored the importance of imagery as a two-way process within such contexts. It was argued that, on the one hand, researchers should carefully curate imagery and use visual metaphors to communicate the emotional resonance of social research; and on the other hand, visual co-creation activities can help to foster efficacy, and feedback tailored meaning into the communications and research process. In such ways, building on recent work about the value of co-learning activities (Barr & Woodley, 2019; Howarth, 2019), it was theorised that imagery can be an important part of 'phronesis', helping to break down the dualism between 'experts:public', within the context of communicating adaptation.

9.2.7 Key contribution #7: Hazard experiences and values did not directly influence adaptation behaviour

This thesis has also added some further contributions around personal experiences of climate hazards and human values in relation to adaptation behaviour.

The work suggests that personal experience of flooding does not have a significant *direct* influence on adaptation behaviour. As noted earlier, prior research about the influence of direct experience on adaptation behaviour has been quite mixed, with some work showing a positive effect (e.g. Działek, et al., 2016; Elrick-Barr et al., 2016), and other work showing non-significant or negative effects (Chaney et al., 2011; Hall & Slothower, 2009). In turn, personal experience was addressed in *Chapters 3* and *4* around flooding, and qualitatively in *Chapter 7* in relation to health impacts*.* Across four regression analyses in *Chapter 4,* personal experience was *not* a significant influence on intentions to take protective action about flooding or climate change, or to support relevant policies. This analysis quite clearly showed that other factors, such as efficacy and threat appraisals were more influential than experience, in this context. This fits with aforementioned research where non-significance of experience is suggested, and broadly fits with van Valkengoed & Steg's (2019) recent meta-analysis, which found direct experience to be less influential than other threat, coping and social factors.

Nevertheless, it should be noted that there is convincing evidence that effects of personal experience on adaptive behaviours are instead mediated by threat and coping appraisals. For instance, Spence et al., (2011) report that experience of flooding only had a minor direct impact on behavioural intentions related to mitigation actions, but had a more substantial indirect influence, as mediated via perceived instrumentality, concern, uncertainty and perceived local vulnerability. Other more recent analysis shows that subjective coping appraisals moderate a link between experience of flooding and negative affect, which in turn implicates mitigation behaviour (Ogunbode et al., 2019) Research around other types of threats, such as traffic accidents, natural disasters and criminal victimisation, also suggests that personal experience can heighten threat appraisals, risk salience and negative emotions and community interaction, *indirectly* leading to action (Becker et al., 2017; Weinstein, 1989). Fittingly, between group comparisons in *Chapter 4* demonstrated that people with direct experience of flooding had significantly different threat coping and social appraisals (e.g. higher perceived susceptibility, and efficacy). Furthermore, the qualitative aspects of the survey in *Chapter 7* seemed to align with such findings, given that that individual experience of respiratory illnesses were

associated with concern about air pollution. In turn, more research could usefully address indirect links between experience and threat appraisal, to add further detail.

While direct experience as a binary categorical variable was not shown to directly predict adaptation action, this thesis nevertheless illustrated the ways experiences are qualitatively interesting and salient nonetheless. Building on previous models of disaster response behaviours, such as the Disaster Management Cycle (Coetzee & Van Niekerk, 2012; Rushford & Thomas, 2015; Tingsanchali, 2012), *Chapter 3* proposed a *'stages of experience'* model that distinguished between five separate stages of flood experiences, helping to explain people's socio-cognitive experiences of adaptation relevant behaviours before during and after a flood event. This model broke down experiences in terms of attitudes and behaviours, and threshold events between stages (e.g. becoming convinced of the flood risk). Experiential knowledge of problem-focused coping was also highlighted in *Chapter 8* as being an important aspect of collaborative engagement about adaptation. Workshops with the WI suggested that trusted in-group members can nurture efficacy by sharing personal success stories about taking adaptive responses; tapping into the power of vicarious learning, verbal persuasion and mastery experiences (Bandura, 1994). Together, this shows that, even if personal experience of a hazard may not directly motivate adaptive behaviour, personal experiences of impacts and coping responses should still be addressed in other ways to benefit communications around adaptation.

This thesis has also contributed much needed evidence around the role of personal values in adaptation. While much research has shown a key role of values for pro-environmental behaviour (see: De Groot & Thørgerson, 2013), such variables have little been assessed as a predictor of adaptation behaviour. *Chapter 4* showed that *universalism* values (i.e. concern for nature and equality) a construct from Schwartz Values Theory (SVT - Schwartz 1992, 2012), were directly significant for climate behaviours (i.e. lowering one's carbon footprint, and climate activism), but not for flood protection behaviours, or policy support relating to flooding (e.g. support for hard engineering). *Chapters 6 & 7* also showed that *political views* were non-significant in relation to coping responses to climate change impacts. These findings are useful as it supports pre-existing claims that climate mitigation activities are values based, but adaptation is not (Kahan, 2013); and also suggests that appraisals of climate health impacts can lead to adaptive responses, irrespective of political worldview. This latter point aligns with other work on climate change and health impacts (Kotcher et al., 2018). These findings are interesting as they support recent evidence that separate pathways explain adaptation and mitigation – with values-based threats facilitating mitigation responses, and personal-based threats influencing adaptation (Zhang et al., 2020). Together with the finding that collective efficacy rather than self or response efficacy was influential for climate mitigation type actions (i.e. low carbon lifestyle and climate activism), the thesis results contradicts the assumption that adaptation and mitigation go 'hand-in-hand' (Brügger et al., 2015).

Despite the non-significant direct role in this work, it seems plausible that different types of values within SVT might play a role for adaption actions. For instance, it is conceivable that given adaptation is largely about coping with a risk to oneself or people in one's immediate network, values other than universalism may be more salient. Thus, it seems possible that the value of *benevolence* (i.e. care for one's in-group members, such as friends and family) might be more influential than universalism. For instance, benevolence could be activated after appraising a threat

toward one's own family from flooding, heat stress or air pollution. Or, perhaps individuals who highly value personal *security* may be particularly motivated to protect their home from climate risks. In this way, values other than universalism may play more significant roles in adaptation behaviour.

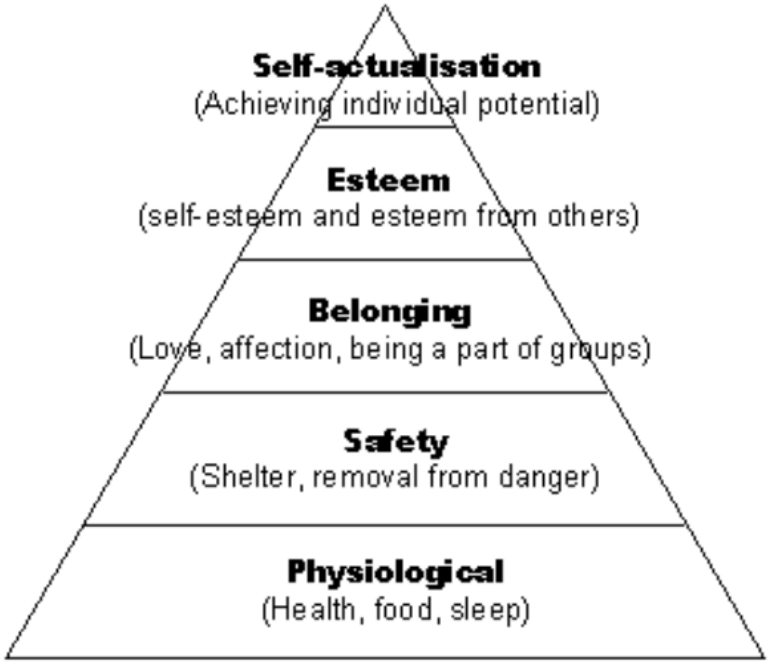


Figure 9.2:2 *- Maslow's Hierarchy of Needs. Source: van der Ven, (n.d.: 7), adapted from Maslow (1943).*

It also seems plausible that values could play an ontologically different role for adaption actions, by amplifying subjective threat appraisals. Research drawing on Maslow's Hierarchy of Needs (See *Figure 9.2.2*) has discussed how values, such as health, safety and a social needs for belonging, can be threatened by climate hazards like sea level rise (Graham et al., 2013), and help explain people's responses to disasters (van der Ven, n.d.) Taking this work further, it is possible that subjective value placed on physiological and psychological needs and other phenomena may have a mediating role for threat appraisals. In other words, the extent to which a hazard is perceived to be threatening might be determined by the value placed on the phenomenon being threatened – e.g. a physiological need (food, air, water), safety need, belonging need and so on. The ascribed value to such needs may be quite persistent across populations, following Maslow's hierarchical structure. In this sense, if a hazard were to threaten an essential physiological need, that hazard would be perceived to be much more severe than if something desirable but less essential for survival, like self-esteem was threatened. This hypothesis is represented in the schematic below (see *Figure 9.2.3*). This would fit with findings in *Chapter 7*, which suggested that a threat posed by air pollution towards the basic human need to breathe heightened people's threat appraisals. However, value may also be subjective, with individual differences. As noted above, *Chapter 3* showed how one flood victim felt the threat of not belonging to their community, posed by relocating, exceeded the threat posed to their personal safety from future floods. In either case, the value given to that which was threatened appeared to determine the level of threat appraisal (which would, in combination with efficacy variables, influence a behavioural response).

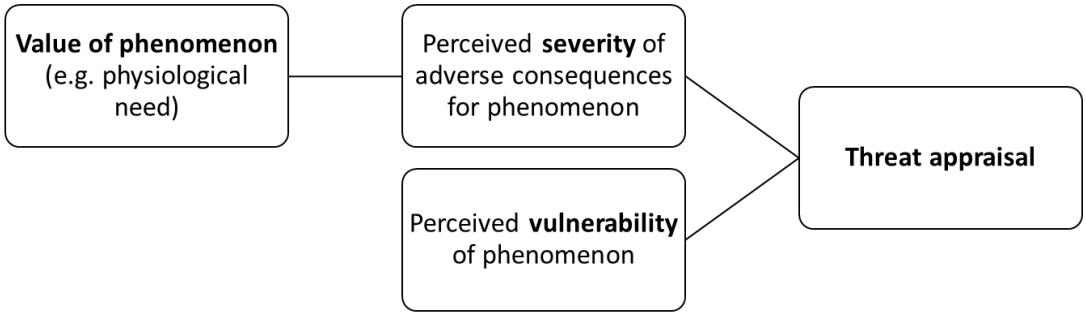


Figure 9.2:3 *- A schematic showing a hypothesised relationship whereby the severity aspect of a threat appraisal of a hazard is influenced by the value ascribed to the threatened phenomenon (such as a physiological need, a psychological need or an object).*

The above model would be interesting to test empirically. This could be seen as bringing the aspect of 'adverse consequences for valued objects' from the value-belief-norm theory (Stern et al., 1999), re-working this to fit within an adaptation context. If supported, this mechanism could be crucial for climate practitioners to take on board when attempting to communicate the threat of a hazard. If the mechanism is founded, it would suggest that practitioners should frame communications to make links between climate impacts and the salient needs of an audience. Nevertheless, until the role of value is clarified through further research, the thesis findings suggest that a values-based approach to communicating climate adaptation (e.g. Corner & Clarke, 2017) may be less desirable than an approach focusing on increasing efficacy, given values were not found to prompt action.

9.2.8 Key contribution #8: Protection Motivation Theory can be usefully modified to explain the communication of climate adaptation

Together, the findings of this thesis are broadly consistent with the Protection Motivation Theory model (Maddux & Rogers, 1983; Rogers, 1975). The clear explanatory power of the core aspects of PMT (i.e. vulnerability, severity, efficacy variables and costs) provides good evidence that adaptation behaviours can be predicted with this model. This adds weight to the recent advocacy of PMT by other researchers focusing on climate adaptation behaviour (e.g. van Valkengoed & Steg, 2019). The applicability of PMT shows that personal level responses to climate threats are processed via the same types of mechanisms that are found in relation to personal health threats – such as smoking, alcohol and so on. In turn, this suggests that many of the principles applied in health communications are also highly applicable in climate communication as well. Overall, I would advocate the use of PMT to explain individual-level processing of adaptation behaviour.

However, while the PMT model was broadly a useful framework, it had some limitations for explaining adaptation and communication. Specifically, while the model usefully explained both threat and coping appraisals – it did not incorporate a range of additional variables that have also been shown to have explanatory value in this work (e.g. social norms, values, freedom threat, and collective efficacy). In turn, this thesis work can be viewed holistically as an attempt to build on, and extend this theory, across the chapters. The chapters have iteratively contributed new

aspects and refinements of the PMT model for communicating adaptation, by considering additional factors alongside those originally included in PMT. Thus, another key theoretical contribution of the thesis regards insights about the effects of some variables that are novel to the PMT framework and in the sphere of climate change adaptation (e.g. freedom threat, simulation bias, communications factors).

It now makes sense to synthesise these extensions into a modified version of the model, as evidenced throughout this thesis. This new model can be referred to as the *Model Optimised for Communicating Adaptation (MOCA)* – and is displayed below in *Figure 9.2.4.*

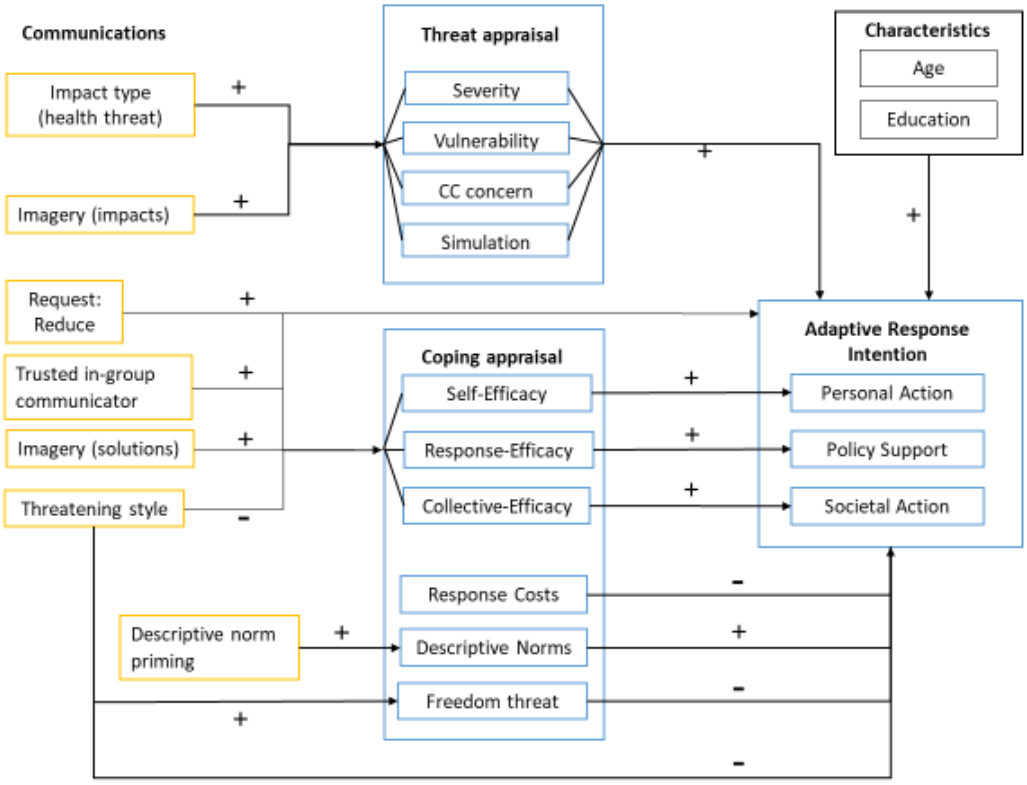


Figure 9.2:4 *- The 'Model Optimised for Communicating Adaptation' (MOCA), an adaptation of Protection Motivation Theory (Maddux & Rogers, 1983; Rogers, 1975), based on the present work. Factors in blue are individual cognitions, yellow are communication factors, and grey are individuals' personal characteristics. Lines represent causal relationships, with (+) denoting a positive association, and (–) denoting a negative association.*

Specifically, the thesis has extended the PMT model through the addition of cognitive factors, personal characteristics, and most radically, a range of communication level factors. The updates cover new aspects of threat appraisal (climate change concern; simulation), coping appraisal factors (collective efficacy; descriptive norms; freedom threat), levels of response (personal action, policy support, societal action), personal characteristics (age, education) and several communication level factors. The positive and negative relationships expressed in the model align with the key findings of this thesis work. Together the MOCA can be viewed as integrating into PMT insights that were found to be salient in this research - which stemmed from environmental psychology research, climate change communications, health communication, and Psychological Reactance Theory (Brehm, 1966, 2000).

Justification for the inclusion of each specific factor is given in *Table 9.2.1*. For now, the MOCA does not include values or experience variables, given their roles were non-significant in this research. Though not discussed above, *age* and *education* were incorporated into the model, as age was an unexpectedly important explanatory factor in *Chapter 4 & 7*, and education level was also significant in *Chapter 7*. When these variables were included into regression models, they showed a positive relationship with adaptive responses – meaning that with greater age and educational attainment, intentions for problem-focused coping were greater. These factors have little been considered in the psychological research about adaptation, and further study should aim to understand their influence in greater detail.

Table 9.2:1 *- Table summarising new factors incorporated into the MOCA extension of PMT and supporting evidence*

Type	Factor	Evidence
Threat Appraisal	Climate change concern	Regression *(Chapters 4, 7)*
	Simulation	ANOVA, Regression *(Chapter 7)*
Coping Appraisal	Collective Efficacy	Regression *(Chapter 4)*
	Freedom Threat	Inductive TA *(Chapter 3)*, Linear Modelling, Regression *(Chapter 6)*
	Descriptive Norms	Linear Modelling *(Chapter 6),* Regression *(Chapter 7)*
Response Level	Social Action, Policy Support, Societal Action	Regression *(Chapter 4)*
Personal Characteristics	Age	Regression *(Chapters 4, 7)*
	Education	Regression *(Chapter 7)*
Communications Factors	Impact type (health threat framing)	ANOVA *(Chapter 7)*
	Threatening style of communication	Linear Modelling *(Chapter 6)*
	Imagery (impacts)	ANOVA, t-test *(Chapter 7)*
	Imagery (solutions)	T-test *(Chapter 7)*
	Trusted in-group communicator	Reflexive Action Research *(Chapter 8)*
	Request type (stop, start, reduce)	ANOVA, Linear Modelling *(Chapter 6)*

The MOCA is useful because it not only provides a refined framework for understanding individual level adaptation, with three levels of possible adaptive responses (personal action, policy support, social action) but, for the first time to knowledge, it provides a framework for understanding and testing the causal effects of communications factors on adaptation. Therefore, the MOCA not only helps researchers to plan, measure and analyse why individuals may take adaptive actions, but also helps to design, test and evaluate communications interventions that aim to increase climate adaptation.

Of course, further research will be needed to replicate this work, and validate the model together. Nevertheless, with the exception of the 'climate change concern' variable, the model may also generalise well to other globally salient issues, such as complex environmental and health threats, where interventions are needed to facilitate personal actions, policy support or societal change (such as COVID, road safety, healthy eating and so on).

9.3 Practical contributions

9.3.1 Recommendations for communicators: *'To threaten or not to threaten?'*

The third key aim of this thesis was to *provide clear recommendations for practitioners who communicate with the public about adaptation.* The theoretical contributions of this work help to answer a broad, but complex question raised in the literature review about whether communications should aim: *"To threaten or not to threaten?"* This question stemmed from mixed research findings, which suggest that both threatening communications (that raise concern, use criticism, apply social pressure), and non-threatening communications (i.e. do not threaten worldviews, do induce fear, do not threaten freedom) can each be effective. Subsequently, this project has shown that people's appraisals of impacts, coping options and communications can each be appraised as threatening or non-threatening; each subsequently implicating whether responses are adaptive or maladaptive. In broad terms, the thesis results suggest that finding the right balance between threat and efficacy appeals during engagement, will be important for facilitating adaption:

A) The threat of climate change and associated hazards should be increased (to raise threat appraisals), so long as efficacy will also be sufficiently addressed as well.

B) This should be combined with substantial efforts to nurture efficacy, ideally tailored to the appropriate level of response (self-efficacy for personal/proximate adaptation, response efficacy for adaptation policy, and collective efficacy for social adaptation).

C) Any threats posed by the style of the communications intervention itself should be minimised (i.e. message style, request type, trust in the communicator).

D) The threat of responding adaptively should be reduced (i.e. lower perceived costs of the coping response being advocated)

E) The threat of not responding adaptively should be increased (i.e. social threat of being in the minority should be made salient).

Past communications practice has broadly not achieved this. A frame analysis of PMT elements within past communication interventions has shown that climate change campaigns typically fail to integrate appeals towards a range of threat and

coping appraisals, and are especially lacking in response-efficacy appeals (Cismaru et al., 2011). Others have observed that environmental campaigns often rely overwhelmingly on assertive communications styles that threaten people's sense of freedom (Kronrod et al., 2012), while news media reports about climate change typically express threat without efficacy (Hart & Feldman, 2014). Examples of recent top-down communications also show that UK government communications have sought to raise a sense of threat without efficacy in relation to personal level adaptation (see *Figure 9.3.1*). While the public believe that collective action around climate mitigation and adaptation can be effective (Fisher et al., 2018; Steentjes et al., 2020), personal and collective efficacy toward climate action is broadly limited (Poortinga et al., 2018). A change in tack is now clearly needed to bolster adaptive responses.

Figure 9.3:1 *- A campaign about flooding by the Environment Agency in 2017 (source: Curtin, 2017). While this campaign included a clear call to action, it is an example of a fear inducing campaign appealing to threat appraisals, without nurturing efficacy beliefs.*

Overall, the findings of this thesis point toward the need to nurture efficacy, alongside threat appraisals. The findings are reinforced by recent meta-analysis showing the key influence of self and response efficacy for climate adaptation (van Valkengoed & Steg, 2019) and work on health communications, showing a need to balance threat with efficacy (Floyd et al., 2000; Peters et al., 2013; Witte & Allen, 2000). Similarly to the present work, an emerging body of research is showing how efficacy to engage in climate change adaptation can be influenced through efficacy appeals and social learning opportunities (Kievik & Gutteling, 2011; Seebauer & Babcicky, 2020; Xue et al., 2016). Consequentially, there is now a clear need to shift toward communication approaches that place efficacy centre-stage, complementing this approach with other best practices.

In turn, *Table 9.3.1* below provides a detailed summary of communications recommendations, synthesising the findings of this work with other evidence-based

recommendations. In this sense, the thesis builds on existing best practice recommendations for communicating about impacts and adaptation (e.g. Corner & Clarke, 2017; Corner, Demski, Steentjes, & Pidgeon, 2020), communicating with victims of flooding (Messling et al., 2015), and communicating about health threats, using an approach based on Protection Motivation Theory (e.g. Maddux & Rogers, 1983; Rogers, 1975). Although one study found that changing the order of threat versus efficacy appeals does not influence the persuasiveness of interventions (Hall et al., 2006), recommendations are presented in a logical order to guide practitioners designing communications.

Table 9.3:1 *- A set of best practice recommendations for communicating adaptation synthesising findings from this thesis with other research*

	Recommendation	Evidence
1.	**Identify your audience –** The starting point is to know exactly who the audience is that are required to deliver some form of behaviour change or response. If there are multiple audiences with clearly distinguishable characteristics and needs, consider developing tailored narratives that speak to each of these groups.	Climate communications research frequently recommends the need to know your audience to understand how to tailor communications (e.g. Coin, 2015; Corner & Clarke, 2017b; Marshall et al., 2016). This was also a key finding from a recent audit of expert opinion on climate change communication (McLoughlin et al., 2018), which formed part of the placement work, discussed in *Chapter 8. Research also highlights that audiences can differ in prior threat and efficacy levels, so this should be considered beforehand* *(Confidence: High)*
2.	**Identify what level of adaptive response is required (personal action, policy support or societal action) –** Are you trying to promote a personal-level action (such as property level flood protection)? Policy support (such as flooding measures taken by government)? Or, societal level responses (such as civic actions about climate change)? This is important, as it will determine the appropriate form of efficacy to nurture (see point 5).	Regression analysis in *Chapter 4* showed that self-efficacy influenced individual-level actions toward proximate/direct threats; response-efficacy influenced policy-level actions, and collective-efficacy influenced broader social actions – like climate activism. *(Confidence: Medium)*
3.	**Use health framings to heighten perceived susceptibility and vulnerability to climate impacts** – If communicators are confident that individuals already have high levels of efficacy, or that efficacy can be sufficiently nurtured through the intervention, they should aim to increase the perceived threat of climate hazards. For general audiences, try to ensure the threat is personally relevant (i.e. individual feels vulnerable to such a threat), is serious, and geographically relevant to your audience. Make links between climate hazards and human health, and highlight impacts towards basic needs (e.g. air, food, water etc.) and psychological needs (e.g. belonging).	Threat appraisals were consistently found to be influential for personal level behaviours across this thesis, as in other research in climate adaptation. *Chapter 7* showed that health framed communications can increase concern about climate change. *(Confidence: high)*

4.	**Nurture efficacy to respond adaptively and tailor efficacy messages to response level –** Invest plenty of effort into nurturing a sense of efficacy through your piece of communication. Consider tailoring the efficacy message towards the form of response being advocated. If the solution is a policy, out of the hands of the public, nurture response efficacy (beliefs that the policy will be effective); If the solution is an individual action, then build self-efficacy (the belief that "I can personally carry out the action"); If the solution requires a collective or societal level effort, then nurture collective efficacy (the belief that "together we can bring about change").	Efficacy was found to be consistently influential across the thesis, and also in meta analyses of adaptation and health behaviours (Floyd et al., 2000; van Valkengoed & Steg, 2019; Witte & Allen, 2000) *(Confidence: very high)* Regression analysis in *Chapter 4* showed that self-efficacy influenced individual level actions; response efficacy influenced policy level actions, and collective efficacy influenced broader social actions – like climate activism. *(Confidence: medium-to-high)*
5.	**Diminish the threat of the coping response -** Reduce the perceived costs that might be associated with the coping response being advocated (e.g. the behaviour or policy). Ideally make requests to reduce, rather than stop an activity altogether. Doing so can help to ensure that personal action, policy support or social actions are seen to be achievable.	Perceived costs of coping were negatively associated with adaptive action in *Chapter 7*, and have been shown in past meta-analysis to consistently influence adaptive behaviours (Floyd et al., 2000). *Chapter 6* showed that reduce requests gave more favourable responses compared to stop requests, for all five outcome variables measured. *(Confidence: high)*
6.	**Ensure that the communications style itself is non-threatening -** The requests being made must be pitched in a way that exemplifies a sense of freedom to choose how to live one's life. Do not coerce, do not be imposing, show don't tell, be non-didactic, do not create a freedom threat, and certainly don't inhibit your audiences' sense of efficacy, or put barriers in the way of adaptive responses more directly.	*Chapter 3* suggested engagement that threatens psychological needs may increase maladaptive responses. *Chapter 6* showed a non-threatening communication style led to more favourable responses for five outcome variables and was the most influential factor tested. This aligns with other work about threatening communication styles (Brehm, 2000; Dillard & Shen, 2005; Kronrod et al., 2012) *(Confidence: high)*
7.	**Balance impact imagery with solution imagery -** show people taking positive actions individually or together where appropriate and show the positive outcomes that can be achieved through the recommended response. Using imagery of impacts may help your audience to simulate and visualise the hazards after your intervention. The ability to form mental pictures of climate threats has been shown to contribute to willingness to take adaptive actions, alongside other psychological factors.	*Chapter 7* showed solution imagery increased self-efficacy beliefs. Solution imagery has been shown in several other studies to increase a sense of efficacy (Metag et al., 2016; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). *(Confidence: high)* Simulation bias was shown in *Chapter 7* to have a small but significant influence on adaptation behaviour. *(Confidence: medium)*
8.	**Layer in descriptive social norms messages –** If the audience happens to be engaged in a maladaptive minority practice, then highlight this and show where adaptive actions are already being taken by the majority. If there is evidence that people are changing their behaviour towards the desirable action, then highlight these dynamic social norms.	*Chapter 6* showed that priming a minority norm status led to favourable responses to campaigns for four of five outcome measures. Much research in environmental psychology shows effects of descriptive social norms (Keizer & Schultz, 2013), and norms have been shown to strongly influence adaptation behaviour in meta-analysis (van Valkengoed & Steg, 2019) *(Confidence: high)*

9.	**Allow trusted in-group communicators to take centre-stage** – In-group communicators can help to convey a sense of risk, but they might be especially well placed to promote efficacy amongst your target audience. Encourage trusted in-group communicators to come forward during engagement activities to share success stories, to build efficacy	Reflective work in *Chapter 8* suggested that trusted in-group communicators are particularly well placed to increase efficacy amongst their in-group. Vicarious learning has been suggested as a key way to increase efficacy (A Bandura, 1977) and there is evidence that trusted leaders have changed climate perceptions amongst their in-group (Maibach et al., 2015) *(Confidence: medium-to-high)*
10.	**Where useful, collaborate to develop communications tailored to your audience's needs –** If you have the time and resources, consider developing a communications plan with your audience, via collaborative learning approaches (e.g. co-creation, co-production). This can help to identify language and framings that resonate with the audience. These activities can allow for social learning facilitated by trusted communicators (see point 9). However, remember that these approaches are designed for two-way learning primarily, and stakeholder biases may need to be negotiated if participants values, needs and aims are not aligned.	Coproduction has been widely recommended as a way to democratise decision making and provide better services tailored to end-uses (e.g. Howarth, 2019). Experts advocated dialogue and coproduction during placement work (McLoughlin et al., 2018). In reflective work in *Chapter 8*, it was suggested that (where appropriate) collaborative engagement can be used to develop tailored engagement, and nurture efficacy through social learning, to good effect. *(Confidence: medium-to-high)*
11.	**Consider communicating links between climate change and air quality -** Air pollution appears to be an ideal issue framing around which to base climate change communications in the UK, as it elicits both heightened threat and efficacy. For more details about employing an air pollution framing, see *Chapter 7* and McLoughlin & Corner, (2020)	In *Chapter 7,* the impacts of air quality were found to be more concerning than flooding, disease and heat stress impacts. 75% of people also reported feeling this was the issue they could do something about (i.e. higher self-efficacy). Other researchers have found air pollution to be a particularly salient impact (Hart & Feldman, 2018; Kotcher et al., 2019; Whitmarsh, 2006) *(Confidence: high)*

These principles can only take the practitioner so far; and are not designed to be prescriptive. Practitioners and change agents will need to be quite creative in how they find ways to apply the principles within their communications practices. Nevertheless, as noted in the introduction and literature review, communications that are repeated through multiple channels, at multiple levels, and in combination with hard measures, are more likely to drive substantial change in society. Therefore, it is hoped that these communications principles can be used to aid not just the design of one off, or one-to-many communications interventions, but to underlie the sort of *deep engagement* the Committee on Climate Change and others have argued is required to facilitate adaptation, and broader action on climate change (CCC, 2018; Corner & Clarke, 2017b). To demonstrate their utility, the next section gives a worked example of how these communications principles can be applied to a real-world communications intervention, in a community level context.

9.3.2 Worked communications example

This section provides an annotated example of a piece of communication, encouraging individuals to take the adaptive response of reducing car usage, to tackle the health threats associated with air quality and climate change. The example is a fictional newsletter entry, written by a trusted member of a local parish church, who is a practising GP. This sort of communication could be the result of a collaborative engagement activity, similar to those discussed in *Chapter 8*.

Figure 9.3:2 *- A worked communications example applying best practices from the present research*

9.3.3 A note on the ethics of tailoring environmental communication

Although the ethics of communications were not the primary focus of this thesis, they should be touched upon briefly, as they are often absent from discussions about environmental communication. There are various ethical dilemmas and implications that environmental communicators must potentially navigate while putting communications research into practice. A particularly salient question related to this thesis is as follows: *Is it ethical to use an understanding of psychological processes to tailor communications that aim to facilitate problem focused actions around climate change?*

There is not room to discuss the various ethical responses possible here; only to give some brief thoughts. Reflecting on the question, what seems clear is that both the intended 'ends' (i.e. the outcomes the communication aims to achieve) and the 'means' (i.e. the way communications are carried out to achieve the ends) are of fundamental importance to justifying the ethics of communications tailored around people's psychology. The 'ends' of climate change communications (i.e. sustainable, climate resilient societies) are easily justified, given (a) overwhelming scientific evidence showing the need to catalyse change amongst society (b) there are a range of co-benefits expected from the change (e.g. benefits to the economy, health etc.), and (c) such changes are not being caused predominantly for self-interest (i.e. rather than political gain, or company profit, the aim is to benefit many people and ecology).

In terms of the 'means' (i.e. whether practitioners should use communications tailored to psychology) this is likely to come down to public acceptability (as well as the ethical position of the communicator themselves). If tailored communications fall within what is deemed to be acceptable by the general public on mass, sometimes referred to as the 'Overton Window' (Dyjack, 2020; Mackinac Centre, 2019), then it is likely to be an justifiable approach. At present, tailored communications form part of everyday life in relation to advertising administered via smart devices, so it's plausible that the means would be acceptable in relation to climate change communications. However, there are many forms of tailoring and targeting, and some specific approaches may be deemed less acceptable than others. For instance, tailoring could be broken down by (a) the level of tailoring – i.e. whether the 'resolution' of the tailoring targets the national level, the group level, or the individual level, (b) How data is obtained and used to inform tailoring (c) whether individuals give consent to be exposed to tailored messages, and (d) whether the tailoring is also communicated transparently. In turn, perhaps research is needed to assess public acceptance of such approaches to climate change communications.

In the meantime, practitioners should reflect on the possible approaches to communications discussed in *Chapter 8.* Approaches to engagement like co-creation that require active participation, are non-coercive and, as discussed, appear to increase partners' sense of efficacy, while also allowing information to be tailored through an active co-learning process. Compared to communications that are one-way, with passive recipients, such collaborative approaches may be more ethically justifiable when tailoring communications around psychological insights. Nevertheless, given collaborative approaches are not always feasible, and can carry unique risks, at minimum, researchers and communicators should ensure their perspective does not treat individuals as '*objects to be changed'*, but instead views people as *'agents of change'* (O'Brien, 2018). Such an approach would be wholly aligned with the broad implications of this research, which highlights the need to nurture, rather than inhibit, people's efficacy.

9.4 Some theoretical predictions about individual, interpersonal and societal processes based on this work

Finally, relating the above research contributions back to broader models of social dynamics, some multi-level, trans-situational predictions can be drawn from this research. Predictions can be made to build on Bronfenbrenner's (1978) Social Ecological Model (i.e. the individual level is interconnected with interpersonal, organisational, community and policy levels), and O'Brien's (2018) three spheres model (personal, political and practical levels). Specifically, predictions from the present work can be made at the *individual level* (i.e. what motivates behaviour in response to threats?), interpersonal/intergroup level (i.e. how do people/groups interact?), and the wider social level (how does change occur in society?). Importantly, these predictions can be made not just in relation to climate change behaviour, but behaviour more broadly, where there are dynamics involving threats and coping responses. These predictions should be treated as preliminary and speculative, to be developed further in future work, and tested empirically. Nevertheless, making these predictions draws back to the interdisciplinarity of the thesis, by highlighting relational and broader social implications of the work.

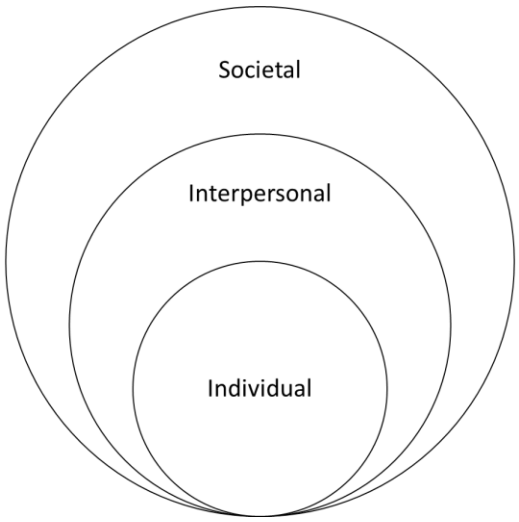


Figure 9.4:1 *- A heuristic distinguishing three key levels where change can occur. As in similar models (Bronfenbrenner, 1978; O'Brien, 2018), these levels are interconnected. Predictions about change at these levels can be made following this research.*

Despite aiming to be generalisable, making predictions at these levels is important in relation to climate change, given adaptation is not only an individual level issue but involves all levels of society (IPCC, 2014). These predictions build on recent work demonstrating the importance of relational dynamics and people's defence mechanisms in response to persuasive communication about climate actions (Kapeller & Jäger, 2020). And also work expressing the importance of leverage points, feedback loops, and social tipping points in transitioning toward a low carbon society that is resilient to climate impacts (O'Brien, 2018; Otto et al., 2020). The present work builds on this past research by highlighting particularly salient processes from the research, such as the importance of nurturing efficacy, threat dilemmas, and non-threatening communication. The following set of predictions thus helps to translate findings about individual-level adaptation into a broader level theory and helps to explain the conditions under which a transformation to a more sustainable society is achievable.

9.4.1 Individual level

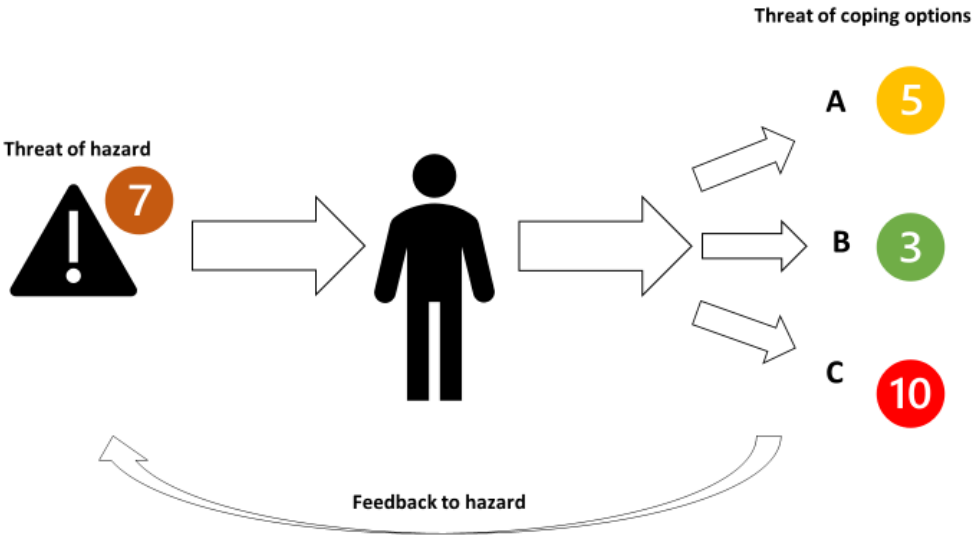


Figure 9.4:2 *- Illustration representing predictions at the level of individual behaviour, assuming equal efficacy associated with the coping options. A hazard poses a substantial threat to an individual (threat = 7). Coping options A (threat = 5) and B (threat = 3) are less threatening than the hazard, while coping option C (threat = 10 exceeds the threat of the hazard. In this instance, coping option B is pursued, given it is the least threatening option, below that of the hazard itself.*

Focus: Explaining individual coping behaviour in response to threats

Predictions:

1. Problem-focused coping responses will occur when:
   - The perceived cumulative threat* of the hazard exceeds the cumulative threat of the coping option (i.e. 'tipping point' breached in favour of coping)
   - Perceived efficacy related to the coping option is also sufficiently high. (Without sufficient efficacy, individuals are expected to engage in emotion focused coping, as demonstrated in other work (Floyd et al., 2000; Peters et al., 2013; Witte & Allen, 2000).

     **Cumulative threat = (perceived severity, mediated by value of threatened phenomena) x vulnerability*

2. Assuming equal efficacy, the least threatening of several coping responses will be prioritized.
3. Problem-focused coping can decrease the threat of the hazard (adaptive) or increase the threat (maladaptive) via feedback, or have no influence (neutral), which in turn feeds back into the decision-making process.
4. A coping response will be required so long as the threat of the hazard exceeds that of coping responses.
5. If several viable coping options pose an equal level of threat, the option where there is greatest efficacy will be selected.

Examples: *An individual may be faced with several competing coping options in response to climate related hazard risk, a health threat, or a socially threatening situation*.

9.4.2 Interpersonal level

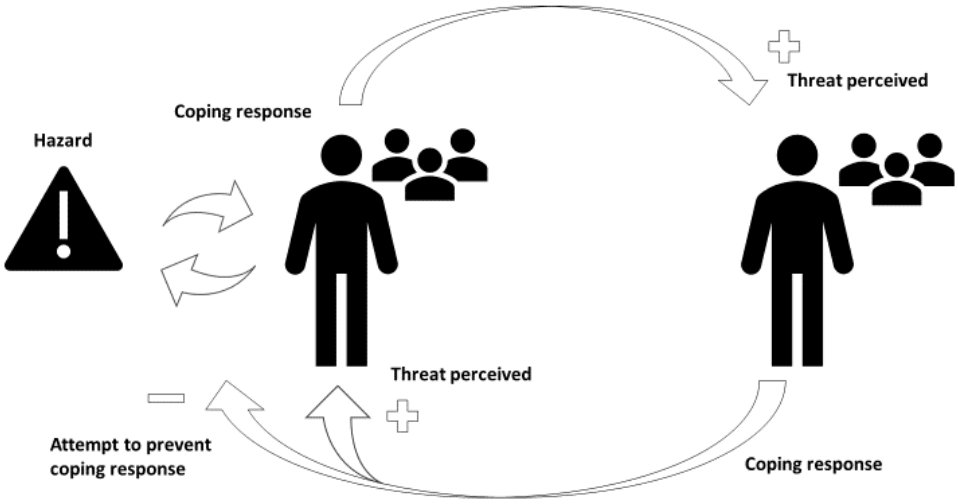


Figure 9.4:3 *- Illustration representing threat and coping feedback dynamics between two groups. Here 'Group A' on the left perceive a hazard and engage in a problem-focused coping response. However, a by-product of this response is that their coping response is perceived to be threatening by 'Group B'. Group B thus engage in problem-focused coping aimed at reducing the threat posed by Group A.*

Focus: Explaining interpersonal dynamics as a threat and coping feedback

Predictions:

1. Interpersonal conflict occurs when the coping response of one party (i.e. individual/group) is perceived to be threatening to another party, or, if a desired coping response is blocked by another party.
2. So long as the coping response of one party is viewed as more threatening than the hazard, coping by another party will be directed toward the threatening individual or group, rather than the source of the threat.
3. Conflict may increase further if subsequent coping increases threat to the other party (i.e. a self-reinforcing positive feedback loop), or conflict can decrease if interpersonal threats are reduced through coping responses (i.e. a negative feedback loop).
4. An individual is more likely to persuade another person to engage in problem focused coping with a hazard, if their communication style is non-threatening.
5. This dynamic can change over time, especially if the threat of the hazard exceeds that of the interpersonal/intergroup threats.

Examples: *An activist group carries out protests, which are viewed as threatening by other members of society, resulting in intergroup conflict. Climate scientists and politicians recommend climate actions, leading to negative responses from climate deniers. Flood victims seeks to dredge their local river, but this is blocked by authorities, leading to anger and lobbying by the flood victims.*

9.4.3 Societal level

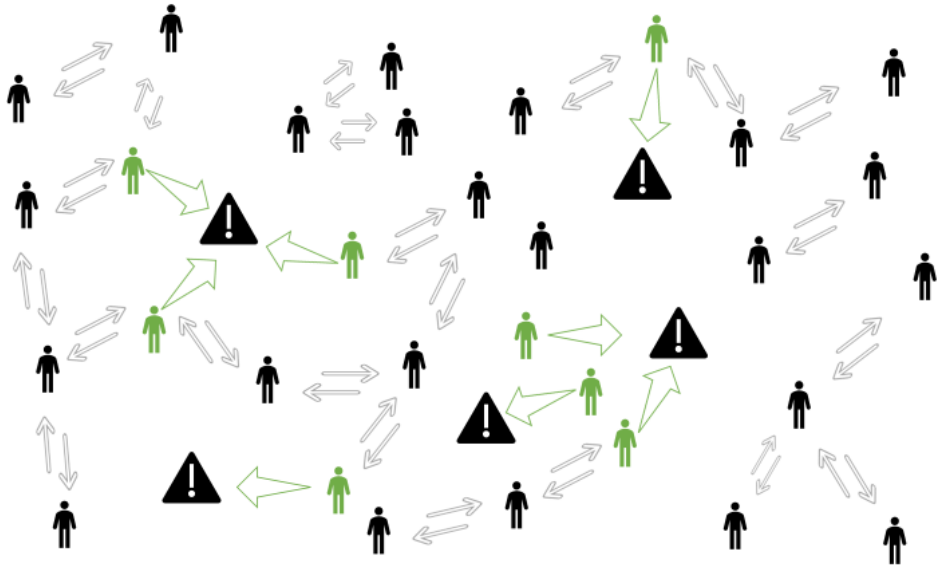


Figure 9.4:4 - Illustration depicting societal processes related to the diffusion of adaptive problem-focused coping. In this illustration non-specific hazards are depicted by the warning symbols. Green figures with green arrows represent people engaged in adaptive problem-focused coping, aimed at reducing the hazards. Grey arrows represent communication processes between individuals (i.e. interpersonal dynamics discussed above).

Focus: Explaining social change over time

Predictions: Problem focused coping is more likely to diffuse through a society when:

- Agents increase the efficacy of other agents in relation to the level(s) of problem-focused coping required (i.e. self, response, collective efficacy).
- Agents reduce the perceived threat of required coping options.
- Agents communicate with others using non-threatening communication styles.
- Agents communicate the perceived threat of the hazard while also increasing efficacy.
- Agents highlight where maladaptive behaviour has minority status.
- Diffusion meets a tipping point whereby maladaptive behaviour becomes the minority.
- Subjective values attributed to threatened phenomena influence perceived threat of the hazard, coping responses, and threat posed by other agents' coping responses.

Examples: *Diffusion of climate change adaptation behaviours through society. Diffusion of health-related coping, such as mask wearing in relation to Covid-19.*

9.5 Conclusion

Overall, this research project has helped to address a range of research gaps around the psychological-level factors driving adaptation, and the way communications can be optimised to promote adaptation. It has shown the broad applicability of Protection Motivation Theory in relation to adaptation behaviour, but also demonstrates how it can be modified to better explain communications. This chapter also discussed a range of communications recommendations based on this work, which can be followed by climate communications practitioners. The final chapter will now summarise the research project, its contributions, and reflects on a future research agenda.

Chapter 10

Conclusions, Impact and Future Research

10.1 Introduction

This final chapter summarises the key findings of this research project, and draws together the overarching conclusions, responding to the three thesis aims:

1) To advance knowledge about the factors that influence adaptation behaviour.
2) To advance knowledge about how communications can be optimised to promote adaptation.
3) To provide clear recommendations for practitioners who communicate with the public about adaptation.

Following summaries of the work completed, reflections are presented about the strengths and weaknesses of the research project, avenues for further research, and ensuing impact of this work.

10.2 Summary of work completed

To respond to the thesis aims, mixed methods research was conducted with members of the public in the UK. While this research had a substantial focus on flooding, it also considered other health impacts of climate change (heat stress, air quality and infectious disease). Focusing on the 'individual level within a social context', this thesis has developed and reported several studies related to communicating adaptation. These studies have addressed public responses to engagement around flooding, perceptions of behavioural and policy responses to flooding, responses to threatening and non-threatening communications (when perceived majority-minority status is altered), and public responses to different framings of climate change health impacts. The following sections summarise the work completed across these studies.

10.2.1 Exploratory work *(Chapters 3 & 4)*

Chapter 3 presented a set of in-depth exploratory interviews with victims of a major flooding event in Cumbria (N=14). These interviews uncovered several key themes concerning perceived threats and coping within the context of flooding. This analysis highlighted a clear psychological need for 'efficacy' amongst those on the frontline of climate hazards in the UK. However, it was also apparent that the way individuals were being engaged with by government agencies inhibited their sense of efficacy. This engagement potentially exacerbated maladaptive responses amongst individuals, such the *strong support for dredging* and localised *reactance* (i.e. going against freedom-threatening recommendations about dredging). An additional part of the analysis identified *five key stages of experience* amongst flood victims, increasing understanding of how individuals typically cope before, during and after a flood event. Overall, analysis of the exploratory interviews, alongside the development of the literature review, led to the selection of Protection Motivation Theory as the main framework for this thesis, given its handling of threats and efficacy. However, at this stage, the PMT model appeared to be limited, even before further application in the research, given the framework does not incorporate other potentially important factors related to adaptation – such as social norms, reactance, and values. Further research was also needed to identify precisely which form of efficacy was most influential – self-efficacy, response efficacy, or collective efficacy.

Chapter 4 followed up this work with a UK-wide survey of flood victims and members of the public (N=279). This study applied an extended PMT model to analyse associations between several socio-psychological factors and support for responses to flooding (including dredging, hard engineering, property level flood protection and

climate activism). Building on the findings from the previous chapter, a regression analysis showed that efficacy variables were consistently influential across possible responses, and that different forms of efficacy (self, collective and response efficacy) explained variance at three distinct levels of problem-focused coping ('personal', 'social' and 'policy' coping, respectively). The analysis also indicated that flood victim respondents differed from other respondents on several threat, coping and social appraisals. Flood victims had higher support for dredging, local place attachments, efficacy, and anger; as well as lower levels of trust in government. This broadly supported the earlier qualitative work.

Together, these two exploratory chapters highlighted there is majority support for dredging amongst flood victims, which is arguably maladaptive given this practice is often ineffective, can exacerbate flooding for communities downstream, and can severely disrupt ecosystems. The chapters also raised questions about how best to communicate climate risks to members of the public who are less vulnerable to flooding. The following investigative chapters therefore focused more overtly on how individuals respond to communications interventions, to understand whether (a) 'majority status' may influence responses to confrontational communications via a protective, 'divisional effect', and (b) how different health impact framings influence engagement with climate change adaptation. Responding to these questions led to a fork in the thesis structure.

10.2.2 Investigative work *(Chapters 5, 6 & 7)*

Building on the previous studies, *Chapter 5* set out to investigate whether an individual's position within a majority group offers some general form of protection from a critical communication intervention. The purpose of this chapter was to test the idea that majorities are, by their very nature, protective (i.e. does an individual's position within a majority offer protection from criticism concerning ongoing behaviour?). This study used a lab experiment (N=93) to test, at an abstract level, how majority status may influence responses to criticism of behaviour during a card sorting task. The study assessed whether there were differences between majority, minority and control groups for implicit physiological measures (HRV and EDA) and explicit measures (state anxiety, behavioural intentions) in response to criticism. No significant differences were detected for stress responses; however, descriptive statistics were suggestive of an effect whereby willingness to change card sorting behaviour was higher in the majority group, versus the minority and control, following criticism. There were several possible limitations in this study design, and, the hypotheses warranted further investigation with a larger sample size, a more explicit communication intervention, and application to 'real world' climate relevant issues.

Chapter 6 followed up by employing an online experimental design (N=190). Again, the idea here was to test whether majorities were protective, but this study extended the focus by additionally looking at potential differences caused by styles of communication. The main stimuli in this study were fictional campaign messages, which allowed the manipulation of *normative status* (majority vs. minority vs. control), *message style* (threatening vs. non-threatening) and *request type* (stop vs. reduce). Selected topics for the campaigns were flooding, energy use, and transport, after a pilot survey revealed that norms in relation to these practices were poorly assessed by the general public. The main analysis showed that message style (threatening vs. non-threatening) was the most influential factor, with non-threatening messages leading to more positive campaign attitudes, higher behavioural intentions, higher self and response efficacy, and lower freedom threat, compared to threatening

messages. The request type (stop vs. reduce), and norm status (specifically, being in the minority) were also consistently influential across four of the five outcome variables (with no influence detected in relation to freedom threat). Requests to reduce maladaptive behaviour had the most substantial influence on self-efficacy out of the campaign characteristics; and, compared to stop requests, led to more positive campaign attitudes, higher behavioural intentions and higher self and response efficacy. Contrasting with *Chapter 5*, being in the 'minority' group was associated with more favourable responses to the messages. Compared to the control, minority status led to more positive campaign attitudes, higher behavioural intentions, and higher self and response efficacy. However, minority status generally had a less substantial influence on people's responses, compared to message style, and request type. A regression analysis also illustrated a positive influence of prior issue importance, self-efficacy and positive campaign appraisals, and a negative influence of perceived freedom threat, on behavioural intentions.

While the investigations in these previous chapters stemmed from the exploratory work in Chapters 3 and 4, relating to vulnerable, flood risk communities; *Chapter 7* aimed to understand how communications may be optimised for the general public. Specifically, the chapter considered people's responses to framing climate change as a health issue and assessed responses to four key health impacts in the UK (flooding, air quality, heat stress and new and emerging diseases). The chapter presented a nationally representative survey (N=1,003) funded by the Climate Visuals project, which incorporated qualitative, quantitative and experimental components to assess appraisals of information and imagery related to these impacts. The study found that air quality was appraised as the most salient of the impacts presented. Specifically, an air quality framing produced significantly higher threat appraisals and negative affect; air pollution imagery was viewed as the most concerning, and most representative of climate change, and air pollution was viewed as the issue that people perceived the greatest sense of self-efficacy towards. This suggests that reframing wider climate issues as issues of air quality might be an effective means of stimulating concern and adaptive behaviours. Additional analysis showed that adaptive actions could be predicted by an extended version of the PMT model. Climate concern, threat appraisal, self-efficacy, response efficacy, response costs, and simulation bias were all significant factors, together explaining 64% of variance in willingness to take adaptive actions. Qualitative responses suggested that a threat to the basic need of being able to breathe was an important theme associated with these responses.

10.2.3 Application of research *(Chapter 8)*

Chapter 8 considered the opportunities and challenges for applying the findings of previous chapters to real-world, collaborative climate change communications. The chapter presented a portfolio of action research experiences, following an academic placement at the charity Climate Outreach. The initial placement work indicated that climate change communication practitioners often recommend co-production approaches and nurturing efficacy, but also highlighted some mismatches with real world practices. In turn, this chapter differentiated collaborative working approaches (e.g. co-production, co-design, co-creation), and reflected on potential benefits and costs. Given the consistent importance of efficacy throughout the previous chapters, opportunities for embedding efficacy messages into collaborative communications were an important consideration. Drawing particularly on experiences of workshops co-created with the Women's Institute, one of the key reflections was that trusted, in-

group communicators seem better placed to increase efficacy amongst their own group members. Alongside working with group -dynamics to build efficacy, the chapter also suggested that one route to effective communications could be co-creating language and visuals that are engaging, yet stay true to the research.

10.3 Research strengths and limitations

At this point, it also makes sense to briefly acknowledge some of the broader thesis-level limitations and strengths.

One key limitation of this work concerns its geographic scope, given the UK focus. In turn, it is not possible to extrapolate certain descriptive findings to non-UK contexts (e.g. extent of self-efficacy in relation to air pollution). Despite this, it seems reasonable to assume that many of the cognitive *processes* discussed would hold up cross-culturally, given the past application of the PMT in different nations (Floyd et al., 2000), and given that variables intrinsic to PMT have been shown to influence adaptation across wide ranging contexts (van Valkengoed & Steg, 2019).

This work also did not look for regional differences in adaptation perceptions, as has been considered in studies comparing perceptions across the UK and Ireland (e.g. Adger et al., 2012). While this would have been interesting to assess, it was not one of the principal aims of this work, which focused more on understanding the core mechanisms through which adaptation behaviours are facilitated, in the context of communications.

There was also a broad focus on the individual level, which may be viewed as a limitation by researchers outside of social psychology. Such a critique is somewhat resonant with the idea that social psychology is *asocial*; too focused on the individual, rather than group level (Taylor & Brown, 1979). However, I would argue that the analysis has allowed useful insights to be gathered about the ways people process information about climate adaptation, and that such knowledge is essential to developing more effective, evidence-based communications. Furthermore, even in research addressing relational processes of adaptation, individual-level perspectives are assessed, and often measured quantitatively via surveys (e.g. Adger et al., 2012).

A further potential limitation was that some of the research methods employed (e.g. lab studies) took place in artificial settings, and thus may be viewed as eschewing real world observation (Jahoda, 2016). However, these methods were not used in isolation in this work, and where controlled experiments were carried out, these allowed cause and effect to be investigated. Use of experimental methods thus gave extremely useful insights about the effects of communications – which would not have been possible with other research approaches.

In turn, this work has a range of strengths. One of the key strengths was the application of *iterative mixed methods* across the thesis, whereby one study developed and built on the preceding research. The transition from exploratory work, to investigative work, to real-world application, allowed studies to be developed in response to interesting findings from earlier chapters, and ensured that research questions are grounded in relation to real-world events. It also allowed qualitative findings to be tested more conclusively in subsequent work, and the limitations of each study to be addressed and built upon. Together, the use of both qualitative and quantitative methods, involving over 1,500 participants across the studies, has also allowed for substantial *triangulation* across the research. This made it possible to

observe broad patterns across different contexts and behaviours, and in relation to different climate impacts (not just flooding, but also heat stress, air pollution and disease). This greatly increases the validity of the conclusions, such as those regarding the consistent influences of efficacy and non-threatening communications.

Furthermore, while there was a strong focus on the individual level, the research has been conducted from an interdisciplinary perspective. The research went beyond psychology, drawing on literature from health communications, disaster risk reduction, and other social sciences. Throughout, the project also drew on expertise from psychology and geography to guide research questions and make sense of findings. As demonstrated in *Chapter 9*, the research thus had clear implications not only at the individual level but also at interpersonal, and broader societal levels. This project also included a hands-on academic placement, which made it possible to test findings in real-world settings and co-create new knowledge. Overall, this meant that not only were a range of theoretical insights generated, but a range of practical insights too. Thus, the project findings can immediately be used to inform climate communication practices.

10.4 Future research

This PhD has included several studies which have contributed new knowledge about adaptation behaviour and its communication. However, much more research is required to advance this knowledge base further. Given the replication crisis in the social sciences (Earp & Trafimow, 2015; Maxwell et al., 2015), the first and most important step would be to repeat these studies, to build on the evidence presented here – and to further validate the Model Optimised for Communicating Adaptation (MOCA), as presented in *Chapter 9*. Future research should also further develop and test the individual, interpersonal and social level predictions detailed in the thesis discussion (see *Chapter 9*). In addition to this, some particularly crucial areas for future research are detailed below, which relate to (a) socio-cognitive factors and (b) communications factors of adaptation. Some have been alluded to in previous chapters, while others have not.

10.4.1 Threats to valued phenomena

First, research should further explore the role of 'human values' other than universalism in relation to adaptation. This could address values such as individuals' priorities for benevolence, or personal security – as conceptualised in Schwartz Values Theory (Schwartz, 1992, 2012). The present research suggested that actions typifying mitigation (e.g. reducing one's carbon footprint or engaging in climate activism) were associated with universalist values. This was consistent with other research on pro-environmental behaviour – e.g. Corner, Markowitz, & Pidgeon, 2014; Kahan, Jenkins-Smith, & Braman, 2011). However, actions typifying adaptation (e.g. household flood protection, or supporting adaptation-relevant policies) were not. Further research is required to understand the circumstances in which different types of personal values may be activated in adaptation contexts in relation to climate hazards. It is certainly conceivable that the value of benevolence, for instance, could be activated in response to perceiving that one's own family is at risk of air pollution, or that individuals who strongly value self-direction might perceive the climate risks of new and infectious diseases to be particularly concerning following the lengthy lockdowns due to COVID-19.

Secondly, further research should also go beyond this to consider how subjective value placed on other needs and phenomena (e.g. one's health, community or

possessions) may influence threat appraisals. Given the evidence presented in *Chapter 3,* which demonstrated that flood victims can experience threats to a sense of belonging, and *Chapter 7*, which suggested the importance of basic human needs in relation to threat appraisals, it makes sense to test how 'value placed on threatened phenomena' could potentially improve behavioural models. A suggestion for modelling this was presented in *Chapter 9*, whereby it was hypothesised that the value placed on a phenomenon will influence the perceived severity of consequences if the given phenomenon are threatened by a hazard. It was also suggested that value ascribed to phenomena may follow a generalisable structure, similar to Maslow's hierarchy of needs (Maslow, 1943). For instance, threats to physiological needs may be most concerning, followed by safety needs, followed by love and belonging, and so on. These ideas would be interesting to test empirically. If supported, these suggestions could be crucial for climate communications to take on board when attempting to induce a sense of vulnerability and threat severity, which was identified as a key motivational factor in this thesis.

10.4.2 'Threat Dilemmas' and 'Tipping Points'

Another issue worthy of follow-up concerns the 'tipping points' of individual level actions relating to adaptation. *Chapter 3* raised the issue that for some flood victims, the threat of not belonging to their community was more threatening than flooding itself. This was referred to as a 'threat dilemma', whereby individuals weigh up (probably on an automatic level) the costs and benefits of coping options against the threat posed by a hazard. While the idea of 'threat dilemmas' and tipping points was an interesting point raised in this thesis, it was not tested empirically, nor was it incorporated into the MOCA in *Chapter 9*, leaving it as an important area for further consideration. This leaves questions open around tipping points. What causes individuals to lean towards one coping option, as opposed to another? What cognitive and social factors must be achieved to 'tip' somebody from a maladaptive form of coping to an adaptive form of coping?

In turn, it seems possible that threat appraisals and coping appraisals may actually be processed in the same way, given that both hazards and coping options can be interpreted as a threat. Specifically, following points above about values, it is possible that both hazards and coping options are appraised holistically, in terms of the cumulative level of threat they pose toward physical health, safety, psychological and social needs. Therefore, it could be that it is the balance, or trade off, between the push and pull of threat and coping that determines action. It is likely that these appraisals could occur mostly at an implicit, automatic level, and on a rolling basis, to weigh up many different possible coping response options. *Chapter 9* visually represented this process as the balance of a set of scales, and provided speculative predictions relating to the individual, interpersonal and broader social level, including tipping points.

In turn, there might be three key avenues for further investigation:

1. How can 'threat dilemmas' and 'tipping points' be modelled? Can these concepts be integrated into the MOCA; agent-based models; or assessed longitudinally?

2. Is it possible to develop and validate a 2-part scale with a common metric, which can be used to score individuals' appraisals of: (a) total hazard-related threat appraisal and (b) total coping-related threat appraisal?

3. In terms of individual-level cognitive processing of threats and coping: Are hazard-threats and coping-threats processed simultaneously, or are they dual processes?

Addressing these questions will help to understand these seemingly novel phenomena in greater detail. If the idea of threat dilemmas and tipping points are supported by empirical evidence, it may help to predict adaptation responses more accurately and refine the explanatory power of the threat and coping appraisal factors discussed in this thesis. This will also be invaluable for the design of interventions. For instance, it could help to identify common trade-offs that individuals make, which force them to take maladaptive coping options, and could help to target communications interventions so that they tilt individuals towards adaptive coping responses.

10.4.3 Stages of experience

Chapter 3 proposed a model of the stages of experience related to fluvial flooding, however, this was not a significant focus in further analyses. As discussed earlier in the thesis, this is another potential area warranting further research. Future work could aim to test the stages of the experience model through quantitative research, and explore how generalisable the model is for experiences of other types of hazards, such as wildfires, sea level rise and heat stress, or global pandemics like COVID-19.

10.4.4 Habits

Habits are repeated, automatic behaviours, and are influential in a range of pro-environmental practices (Klöckner, Verplanken, 2013). However, very little research has considered the role of habits for climate adaptation (van Valkengoed & Steg, 2019). This is despite there being several potential habitual, repeated aspects of good adaptation practices. For instance, checking household flood defences, checking weather forecasts, or attending a weekly community action group may have automatic, habitual qualities. One study has reported a non-significant direct influence of habits on adaptation intentions, related to farming practices in Vietnam (Dang et al., 2014). Nevertheless, further research should aim to assess the possible role of habits for other types of adaptation actions, in other contexts.

In addition, given that research has shown that adaptation often occurs as a reaction to the disruption caused by extreme weather events (Adger et al., 2012), it would be interesting to consider such events in terms of habit discontinuity. Perhaps such events can lead to ‘unfreezing’ of old habits, and in turn may be optimal moments to administer behaviour change interventions around adaptation, as has been tested in relation to other environmental practices (Verplanken et al., 2018; Verplanken & Roy, 2016).

10.4.5 Further research about communication factors

Finally, further research is needed to understand how the design and characteristics of other types of communications interventions can affect the range of cognitive factors discussed in this thesis. There are many avenues this could take, but one of personal interest concerns the roles that creative communications, including films, literature, visual arts and music may be able to play in adaptation. Art forms with a narrative element may be particularly interesting to research, given that sharing of adaptation-relevant stories was a positive aspect of the workshops discussed in

Chapter 8, and given that self-efficacy can be increased via vicarious learning (Bandura, 1977). Narratives can offer increased comprehension, interest, and engagement when communicating climate science (Dahlstrom, 2014), and past research has demonstrated that narratives can be effective in promoting attitude change, especially when audiences are absorbed or 'transported' into the narrative (Green et al., 2004; Green & Brock, 2000; Thompson & Haddock, 2012). However, other research has also shown that while climate change films can increase concern via narratives and imagery, this concern is not necessarily sustained (Leiserowitz, 2004). Further research is therefore needed to understand how to optimise narratives and creative communications to facilitate adaptive responses.

10.5 Impact

This section briefly discusses how the results of this thesis can be applied in the future, through collaboration and dissemination, to increase the impact of the PhD. In addition to developing a set of papers for peer-reviewed academic journals, I also hope to share the findings through other forms of communication.

10.5.1 Collaboration with Climate Outreach

As discussed in detail in *Chapter 8*, this PhD involved a placement with Climate Outreach, which provided a range of opportunities to embed research findings into real-world communications practices. I was honoured to be made an Associate of Climate Outreach as a result of this placement, meaning that there will be a collaborative relationship with the charity into the future. In addition to the reports, projects and publications detailed already (see *Chapter 8*), upon presenting my preliminary findings to the team members, there was clear interest in creating a communication-focused report summarising this thesis project. This is one key way in which I hope to further share the findings of this work, which will help to bridge the gap between this research and practice within climate change communications.

10.5.2 Dissemination with policy makers

Another key way that I aim to increase the impact of this work is to communicate the results with policy makers and professionals in fields related to climate impacts and adaptation. I have started to do this already, for instance, by disseminating results through a presentation at the annual *Communicate* event series (see *Figure 10.5.1*). The audience included, among others, key informants from the Environment Agency, Defra, Ofwat, Bath Council and the Dry Project (a climate adaptation project). I presented findings about the psychological factors related to flooding behaviours and detailed how communication with flood victims may unintentionally pose threats towards efficacy. Given more research findings have emerged since that presentation, I aim to further disseminate the research to policy makers.

Figure 10.5:1 *- Presenting research findings at 'Water Stories' at Bath Guildhall, as part of the Communicate: 2018 event series. Image: Niall McLoughlin*

10.5.3 Wider dissemination

In addition to the above, I hope to amplify the dissemination of these results through other forms of communication. One way in which I have already started to do this is through some creative communications approaches. For instance, at the start of this research, I put together an interactive video about the project, which allowed viewers to click on parts of the video to learn more about different aspects of the project. In the middle phase of the research, I wrote a piece for the ESRC writing competition. My submission, *The Psychology of Flooding*[1] communicated the experiences of flood victims in *Chapter 3* and drew on findings of the expert audit research noted in *Chapter 8.* More recently, I put together a film pitch for the Flickers for Future funding call, attempting to embed the practical recommendations of the present research (see *Chapter 9*) into a piece of creative, narrative-based communication. I hope to build on these creative projects further after concluding this research, to connect with audiences who might not otherwise engage with academic literature.

10.6 Concluding remarks

This thesis set out to generate new knowledge that can be used to optimise communications interventions to promote adaptive responses to climate change (i.e. individual-level behaviours that aim to reduce the negative effects of climate impacts). This research is of crucial of importance now, given the pressing need to facilitate adaptation to climate change, and due to the gaps in research knowledge about the psychological factors relating to public engagement with climate adaptation.

Focusing on flooding and other health impacts in a UK context, this thesis has contributed insights about (a) the socio-cognitive factors that promote adaptive responses to climate change, and (b) how such factors can be translated into the design of more optimal communications interventions. Through mixed-methods research with the public, this research has shed light on a range of psychological factors related to adaptation. Most notably, the research has found consistent

[1] See: https://www.socialsciencespace.com/2019/04/the-psychology-of-flooding-an-escr-better-lives-essay/

evidence of the influence of efficacy variables in promoting adaptive responses to climate impacts, and the importance of non-threatening communications practices to nurture efficacy. The findings presented in this work have clear implications for policy makers and communicators alike. Together, the research could be interpreted as a signpost, suggesting that broad-level reorientation is required in our approach to climate engagement. It suggests the need to shift away from the old path of fear appeals and threatening communication approaches, towards a new path of *efficacy appeals*. Thus, if there is one key takeaway from this work, it is this:

Communicators and policy makers should do everything they can to nurture efficacy to facilitate adaptive responses to climate change.

Postscript

Human behaviour as coping

To close this work, I briefly wish to detail how my broad perspective on human behaviour has shifted whilst carrying out this research. Though not a central aim of the thesis, a reflexive shift has emerged in my thinking as a by-product of this work. I have come to consider that it would not be hyperbole to suggest that *all human behaviour can be understood as 'coping'*. Joining the dots of this thesis' findings, reviewing the existing literature on threats and coping, and observing globally significant events unfold in areas not related to this thesis, has forced me to reflect upon this matter – noticing the linkages and patterns between seemingly unrelated human practices, actions and activities.

The APA (2020a: npn) define coping as:

> *"the use of cognitive and behavioural strategies to manage the demands of a situation when these are appraised as taxing or exceeding one's resources or to reduce the negative emotions and conflict caused by stress"*

and define coping behaviour (2020b: npn) as:

> *"a characteristic and often automatic action or set of actions taken in dealing with stressful or threatening situations. Coping behaviours can be both positive (i.e., adaptive), for example, taking time to meditate or exercise in the middle of a hectic day; or negative (i.e., maladaptive, avoidant), for example, not consulting a doctor when symptoms of serious illness appear or persist."*

While some human *behaviours* are self-evidently forms of *coping* – for instance, taking medication to alleviate symptoms of a common cold, or putting a bandage on a wound – other behaviours seem less related to coping. Yet even the trivial, everyday activities we carry out, which do not seem to clearly negate any threats or suffering, appear to be forms of coping as well. Driving a private car, for instance, is a way people have opted to reduce time spent travelling. Switching on the light allows one to carry out tasks during darkness. Going for a walk amongst nature may help to reduce stress. Reading a book, social contact, listening to music and playing sport all help humans to cope with the day to day stresses of life, in some way.

In turn, it could be argued that behaviour may be broken down into four key types of coping (to coin some new terms): Explicit coping, Implicit coping, Facilitative coping, and Legacy coping. *Explicit coping* is that which directly responds to a clear and present threat (e.g. using a face mask during a pandemic, or bailing water from a sinking boat). *Implicit coping* is where a coping behaviour may be taken, indirectly resulting from, or without conscious acknowledgement of, a threat (e.g. seeking to attain high grades at school, due to an unacknowledged fear of admonishment by one's parents or peers). *Facilitative coping* is that which supports or enables explicit coping, though may not directly negate a threat (e.g. opening a door to reach someone who is in need, or, commuting to a workplace, so that one can earn wages to cover living costs). *Legacy coping* is where coping behaviours have become so

pervasive, habitual or routine, that the original threat and coping needs are barely perceptible (e.g. driving a car to work, brushing one's teeth, or, using a computer to write a thesis).

Conducting a simple thought experiment reveals how we are always coping with something, through our actions. With each of the behaviours noted above, the situation would, hypothetically speaking, become significantly more taxing and threatening, if the explicit, implicit, facilitating or legacy behaviour were prohibited. Such a restriction would reduce an individual's ability to manage the demands and stress associated with a situation and could uncover latent stressors. This thought experiment suggests these activities are forms of coping, not simply because restriction inhibits perceived freedom, but because such restriction would increase stresses resulting from underlying threats. The complexity of unpicking this is increased, however, as some behaviours may combine different forms of coping, by being facilitative and legacy coping, or managing different explicit and implicit stressors, simultaneously.

Further to this, all major, general theories of human motivation advocated over the past century can be linked by the common theme of coping. The view that human behaviour is driven by the will to *pleasure* (Freud, 1955), the will to *power* (Adler, 1966), the will to *meaning* (Frankl, 2004) a hierarchy of *needs* (Maslow, 1943), or being guided by *values* priorities (Schwartz, 1992), are each, simply, discrete forms of coping. Values, for instance, represent coping ambitions – abstract 'end states' that are viewed as desirable within our lives and for society.

It is of course not entirely new to argue that coping pervades human life. For instance, Becker (1973) asserted that in order to cope with the reality of death, human beings seek out the comfort of organised religions, join social movements, or attempt to become cultural icons, to persuade themselves of an illusion where they are significant within the universe. One requires no convincing to see that death is a present threat that all humans face, and psychologists have found links between perceived existential threats and pro-environmental behaviour (e.g. Fritsche et al., 2010). However, death, while the most inescapable of threats, is just one of many threats that humans are forced to endure throughout their lifetimes. As noted in this thesis, individuals can perceive their health, safety, resources, morals, values, identity (and so on) each to be threatened.

Myriad threats influence coping across a vast range of settings and contexts, and observing their interactions can help in some small way to interpret not only psychology, but events in politics, economics, history, and so on. In recent UK politics, for instance, polling suggests that people who voted to leave the EU were coping with *perceived threats* related to national sovereignty, immigration and multiculturalism; while remain voters believed that leaving the EU posed great threats to the economy, jobs, trade and international collaboration (Lord Ashcroft, 2019). The subsequent threat posed by the referendum result led many to take to the streets in counter-protests, giving rise to the UK's second largest demonstration within the 21st century. In relation to climate change, while social movements like the School Strikers and Extinction Rebellion respond to the threats posed by rising greenhouse gas emissions, they have concurrently been described as posing significant threats to society, the fossil fuel industry and 'freedom' itself (Carrington, 2017). Similar patterns of 'call and response' involving threat and coping dynamics can be observed in relation to any number of recent socio-political controversies, irrespective of

ideologies – from the coping actions of pro-democracy advocates and anti-racism campaigners; to anti-vaxxers and anti-globalists. In all these examples, perceived threats can be either reinforced or reduced by the coping behaviours of other humans in society, through positive and negative feedback loops.

Furthermore, even simulated behaviour involves threats and coping. There is clear evidence that humans have an enhanced capacity to learn vicariously about threats through social relationships (Olsson et al., 2020). But further than this, it has been theorized that fictional stories and other art forms can also help us to vicariously develop coping abilities, via deep and immersive simulative experiences (Mar & Oatley, 2008; Tooby & Cosmides, 2001). And, though the science of consciousness is still developing, one of the most convincing explanations of dreams is they are an evolutionary cognitive mechanism, facilitating coping. The role of dreams may be the simulation of potential threats, increasing threat perception and threat avoidance in wakefulness (Revonsuo, 2000; Valli et al., 2005).

But why is it useful to conceive of behaviour as coping in these ways? Viewing behaviour as coping helps to explain behaviour, because it prompts us to question *where the threat is* underlying a given behaviour. By asking questions about the threat at hand, it helps to identify the reasons why behaviours are (or are not) carried out. In many ways, this is exactly what this thesis has done – it has sought to locate and understand the threats behind individuals' coping behaviours relating to climate change. Once the threats are understood, then interventions can reduce or increase perceived threats, and enhance coping appraisals to effect coping behaviours.

The idea that *behaviour is coping* has become particularly clear in the final stages of this PhD. As I am writing this, we are in the midst of the COVID-19 pandemic, where individuals and societies have been forced to cope with the threat of the virus in myriad ways. Societies, in a matter of weeks, were turned upside down in attempts to minimize the negative impacts of the virus, again illuminating the fundamentality of coping to human life.

Together the intrinsic relationship between threats and behaviour appears to point towards one clear conclusion:

All human behaviour is coping.

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Chapter 1

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Chapter 2

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Chapter 3

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Appendix

A. Policy and behavioural proposals as presented in *Chapter 4's* flooding survey

Table A:1 *- All 'Proposal Vignettes' relating to flooding and climate change as presented in the flooding survey in Chapter 4*

Policy	Text (as presented in survey)
Dredging	**PROPOSAL FOR RIVER FLOODING: DREDGING** **Proposal**: 'Dredging' is an approach to floods management taken in order to improve the flow of water within a river, or improve land drainage, through removal of material. **What this proposal involves**: **Dredging** is a term for underwater excavation, and usually involves **deepening a channel** by **removing material** like sediment (silt, sand, stones, gravel etc.) excavated from a riverbed. Dredging often involves using large machinery, such as **specialised barges** equipped with **vacuums**, or **diggers** stationed on a riverbank. Dredging may also involve removing scrub from riverbanks, and **spraying herbicides** in order to remove vegetation adjacent to the river. Decisions are then made about what to do with material removed during the dredging process, according to national legislation, and local contexts.
Hard Engineering (Rivers)	**PROPOSAL FOR RIVER FLOODING: HARD DEFENCES & ENGINEERING** **Proposal: '**Hard Defences' include a range of measures that may be taken in order to control the flow of river water, or provide flooding protection to a specific area. **What this proposal involves:** **Raised river-banks and flood walls** may be constructed in order to exclude flood waters from the adjacent land and property. **Storage reservoirs** may be used to regulate the flow of water in a main river channel by redirecting flood waters to a holding area and allowing the water to flow back into the main channel after the flood. **Sluices and barriers** may be used to control and regulate the flow of water down the river channel. Measures could also include improving **floodwater pumping** capacity, raising **temporary walls and barriers** around areas, or other solutions involving machinery or technologies to reduce flood risk, and water levels.

Hard Engineering (Coastal)	**PROPOSAL FOR COASTAL FLOODING: HARD DEFENCES & ENGINEERING** **Proposal:** The term 'hard defences' in coastal contexts describes a range of measures that may be implemented in order to prevent floodwaters from reaching the land and damaging property. **What the proposal involves:** The construction of **sea walls, levees,** and **embankments** may be taken to reduce the amount of water that breaches on-land. Constructing **rock armour and boulder barriers** (large boulders piled up on beaches) aims to reduce the energy of waves and allow the **build up of beaches**. Hard measures may also involve constructing **groynes, artificial headlands and breakwaters**, in order to manipulate the way sediment is deposited on beaches, and in turn, reduce the energy of waves and surges. Constructing sea walls may also provide protection to land and buildings by reducing erosion.
Natural Flood Management (Rivers)	**PROPOSAL FOR RIVER FLOODING: NATURAL FLOODS MANAGEMENT (NFM)** **Proposal:** Natural Floods Management (NFM) can involve a set of measures using naturally occurring features and processes in a catchment area in order to reduce the height of a flood or to delay the arrival of the flood peak downstream. **What this proposal involves:** NFM can involve **storing water** by using, and maintaining the capacity of ponds, ditches, embanked reservoirs, channels or land. It may involve **increasing soil infiltration,** to reduce runoff or saturation. It may involve **slowing water** by increasing resistance to its flow, for example, by **planting floodplain trees** or riverside woods, or **maintaining meanders** (river bends), rather than artificially straightening channels. It may also involve **allowing flooding** in some areas of a floodplain, as well as sympathetic land management practices, such as **planning restrictions** for building on floodplains. Indirectly, it may support nature conservation.
Natural Flood Management (Coastal)	**PROPOSAL FOR COASTAL FLOODING: NATURAL FLOODS MANAGEMENT (NFM)** **Proposal:** Natural Floods Management (NFM) can involve a set of measures using naturally occurring features and processes along a coastline area, in order to reduce wave energy and flooding on land. **What this proposal involves:** This may include Coastal Managed Realignment (CMR) where **deliberate breaching** or **removal of existing seawalls**, or embankments **allows waters to inundate** the land behind, or **controlling the inflow and outflow** tidal waters behind a defence. **Coastal erosion** in some areas may also be permitted to supplement sediment supply. It may involve **managing natural features** by regenerating saltmarshes, recharging beaches, as well as dune and shingle ridges, or other types of ecosystems. It may involve **removing manmade features** such as groynes, bastions, outflow pipes, river training walls, quays and harbour walls that impede sediment drift. This is in order to allow natural sediment movement to reassert itself.

Behaviour	Text (as presented in the survey)
Property level flood protection	**ACTION: IMPROVING PROPERTY-LEVEL FLOOD PROTECTION** **Definition:** Property level flood protection involves changing, adding or removing features of a house or property in order to increase its resilience to flooding. **What this action involves**: Property adaptation and protection may involve **seeking advice** (for example, from a building surveyor) on how to protect one's property against flooding. Following this, it may involve **buying flood protection** products, such as flood **boards** or **sand bags**, **barriers**, installing **pump systems**, or other types of property level defenses. It may involve **sealing areas that are prone to flooding**, like cracks or pressure points, or **changing household features**, for instance, to furnishings or construction materials that dry out quickly after getting wet. In some cases, household adaptation may involve designating the lower levels of a property as a floodable area.
Climate Change Mitigation	**ACTION: TAKING PERSONAL ACTIONS TO MITIGATE CLIMATE CHANGE** **Definition**: Personal climate change behaviours are actions that individuals take in order to reduce the impacts or climate change, or increase resilience to climate change impacts. **What this action involves**: Personal behaviours taken to reduce the impacts of climate change may include **learning more** about climate change and **staying informed**, and calculating one's personal **carbon footprint**. It may involve reducing one's carbon footprint, though **reducing energy consumed** by household heating and cooling systems, or using **sustainable transport** choices like public transport or cycling. It may also involve substituting products for sustainable alternatives, and adopting a more **sustainable diet**. This diet may involve a reduction of beef consumption, and buying foods from local sources. Behaviour changes may also involve **recycling** more, **reusing** or upcycling old items and **reducing waste**.
Community Flood Action	**ACTION: PARTICIPATING IN COMMUNITY FLOOD ACTION GROUPS** **Definition**: Community flood action groups are community based resilience groups, which, on behalf of local residents and business, act in order to prepare for and minimise the effects of flooding. **What this action involves**: Participating in a community flood action group may involve **providing relief** to people affected by flooding, such as food, shelter, household items or products. It may involve **attending meetings** and consultations with other volunteers and **planning actions** in a local community or further afield. It may involve contacting and **lobbying a local elected representative** and urging them to do more to reduce the impacts of flooding, or raising awareness about flood risks in other ways. It may involve **participating in rally or protest** in support of action to reduce risks of flooding. It may involve practical work to **reduce the risks** of flooding in a local area, or **donating money** to the flood action group to support the group's actions.

Climate change activism	**ACTION: PARTICIPATING IN CLIMATE CHANGE ACTIVISM** **Definition**: Climate change activism may involve a number of individual and group based behaviours that are carried out in order to increase pressure on leaders, and decision makers to reduce the impacts of climate change. **What this action involves:** Climate change activism may involve contacting and **lobbying a local elected representative** and urging them to do more to reduce the impacts of climate change. It may involve **raising awareness** about climate change, or participating in **rally or protest** in support of action to reduce the risks of climate change. It may involve joining or volunteering with an organization and doing practical work to **reduce the risks** of climate change, or **donating money** to an organization to support their activities. It may involve **attending meetings** and consultations with other volunteers and **planning actions** and activities in the local community or further afield.

B. Email concerning research ethics during an academic placement

RE: Ethics

Nathalia Gjersoe <N.Gjersoe@bath.ac.uk>

Thu 30/08/2018 09:45

To: Niall Mcloughlin <N.C.McLoughlin@bath.ac.uk>; Rebecca Wise <R.Wise@bath.ac.uk>
Cc: Rob Keegan <rob.keegan@bristol.ac.uk>; Ana Bullock <A.P.R.Bullock@bath.ac.uk>; Ian Walker <I.Walker@bath.ac.uk>; John Brice <J.R.Brice@bath.ac.uk>

Dear Niall,

We discussed this recently with John Brice. At the time we agreed that the ESRC guidelines were vague in this regard and he was going to contact them to ask specifically about their requirements with regards research conducted on a placement which may ultimately be used for the ESRC-funded PhD/publication.

Currently our reading is that it is the placement provider's responsibility to ensure the ethical conduct of research done for them, and not the university's responsibility. So there is no requirement from us that you seek ethical approval for the research you conduct on placement. However, I would recommend that if you intend to do research that touches on any ethical issues (e.g. vulnerable populations, collecting identifying information, deceit, sensitive or upsetting issues, etc, basically a yes to anything in Section 2 of the EIRA1) then you seek advice from SSREC. We have recently introduced a quick-response route that is just seen by the Chair rather than having to wait for the committee meetings and we are happy to respond to queries if you have any concerns as the research plans develop. This would better cover you if a complaint or problem arises in the course of the research. At a minimum, if you are collecting any data that could identify the participant, please ensure that you have understood your responsibilities under the new data protection act. I am happy to advise if necessary.

If you are collecting anonymous data on surveys with adults (as much of your previous work has been) and not addressing any sensitive issues then I don't think there are really serious ethical concerns and these should be able to be addressed by the placement provider. The BPS guidelines are linked on the psychology ethics moodle page. They have additional guidance for doing online research, also linked on the psychology ethics moodle page, which is surprisingly useful and I would advise reading through to ensure you're in line with your professional responsibilities. I don't know what the ethics oversight is like at Climate Outreach but I think those two documents would stand you in good stead in the absence of any other ethics review.

All the best, Thalia

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